THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXV. No. 608.] LONDON, JANUARY 5, 1875. [27TH YEAR.] Price 6d.

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Retorts, Retort-Fittings, Condensers, Scrubbers, Purifiers, Station-Meters, Governors, Rack and Screw Valves. Gas and Water Mains always in Stock.

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Combining most recent improvements in principle and manufacture; upwards of 200,000 already in work, giving highest satisfaction.
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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

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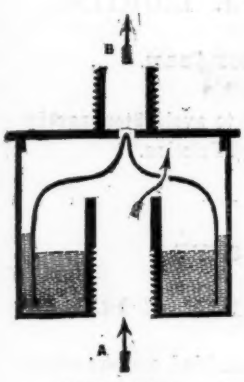

Sectional View.

Glycerine neither evaporates nor freezes at ordinary degrees of temperature.

Inside a Lamp.

Under a Globe Burner.

The RHEOMETER is a new apparatus of measurement; it is entirely made of "metal," and works "inside a closed vessel." It determines the quantity of gas to be consumed; and this quantity remains unchangeable, whichever be the burner employed, and whatever be the pressure.

ADVANTAGES.

For Domestic Purposes.—Saving of Gas.—Possibility of adopting low-pressure burners, which give as much as "four times more light" than the others, with the same volume.

For Gas-Works.—It is no longer necessary to consider any differences of level, or any variations in pressure. Alterations in burners, or a change of burners, will not affect the consumption. The quantity stipulated by contract is always supplied to all the lamps.

Subscriptions by the hour are no longer a matter of difficulty; in such cases the "sealed" Rheometer replaces the ordinary meter.

For Town Lighting.—The Rheometer is a guarantee that the contract for lighting is duly carried out. Thus, good burners may be adopted, and the lighting thereby improved, without the gas company having any interest in intervening to oppose such a measure.

All Orders should mention what quantity per hour the Rheometer is intended to regulate.

Depot: At the ECONOMIC GAS STOVE COMPANY, 74, STRAND, ADELPHI, W.C.,

WHERE THEY MAY BE SEEN IN ACTION.

Adamas Works: 54 to 66, ST. PAUL ST., NEW NORTH ROAD, N. Offices: 19, GT. GEORGE ST., WESTMINSTER, S.W.

One Sample Rheometer sent Carriage Paid to any part of the Kingdom on receipt of 5s. in Stamps.

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PUBLIC LIGHTING

ON THE

AVERAGE METER SYSTEM.

LAMP METERS, IN CAST-IRON BOXES,

FOR

Fixing in the Footway, flush with the Pavement, with roughed Lids.

NOTE.—These meters were originally invented by William Sugg, in conjunction with Mr. Thos. Hawksley, Past-President of the Institute of Civil Engineers. They have been in use at Nottingham since 1866, and are still at work. The Gaslight Company and the Corporation were both quite satisfied with the results.

They were also introduced at Folkestone in 1869 by the late Mr. T. G. Barlow, Editor of the JOURNAL OF GAS LIGHTING. The success of the system put an end to a very long and troublesome dispute between the Gas Company and the local authorities. They are still at work with the same satisfactory results.

They have since been used in several important towns, with equally good results.

No other kind of Lamp Meter has ever achieved so complete a success.

WILLIAM SUGG'S

PATENT PUBLIC LAMP GOVERNOR,

WITH

STEATITE INCORRODIBLE BURNERS.

Guaranteed to give the greatest amount of light for the quantity of gas consumed.

The amount of light for a like quantity of gas is at least 30 per cent. over that given by those burners generally employed in public lighting.

NOTE.—Many of William Sugg's original Governors first applied to public lamps are still at work in the Imperial Gas Company's Districts, where they have been in constant use, with very slight repairs, now more than 14 years.

Upwards of 400,000 of these, and those of William Sugg's later inventions, are in use in various parts of the globe.

The Patent Lamp Governor is especially serviceable for home and foreign use. It can be taken to pieces, new leathered, and put together again in a few minutes by any ordinary workman.

By the principle of Double Regulation, a finer and steadier light is secured with the greatest illuminating power, and the least loss of gas in case of the breakage of a burner.

This system can be readily applied to all Lamp Governors, new or old.

LEVER COCKS FOR POLE LIGHTING,

STRONG AND SERVICEABLE.

These Cocks are carefully made so as to avoid Stoppage by Naphthaline, Leakage, and Friction.

WILLIAM SUGG'S

POLE LIGHTERS

Are acknowledged to be the best of their kind, and are almost universally adopted.

This is one of the spécialités of the house.

LANTERNS VERY STRONG, WITH PORCELAIN TOPS.

MODERN STREET LIGHTING,

BY WILLIAM SUGG, A.I.C.E.

Price 1s. 6d.

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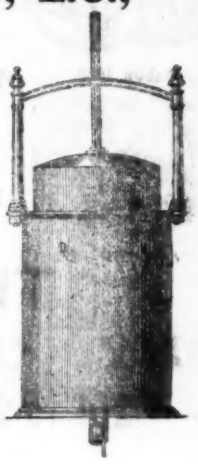
SOLE MAKERS OF

HUNT'S PATENT
EQUILIBRIUM GAS GOVERNOR.



In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

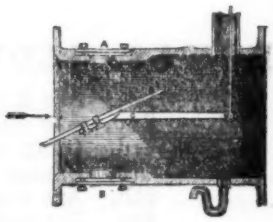
The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

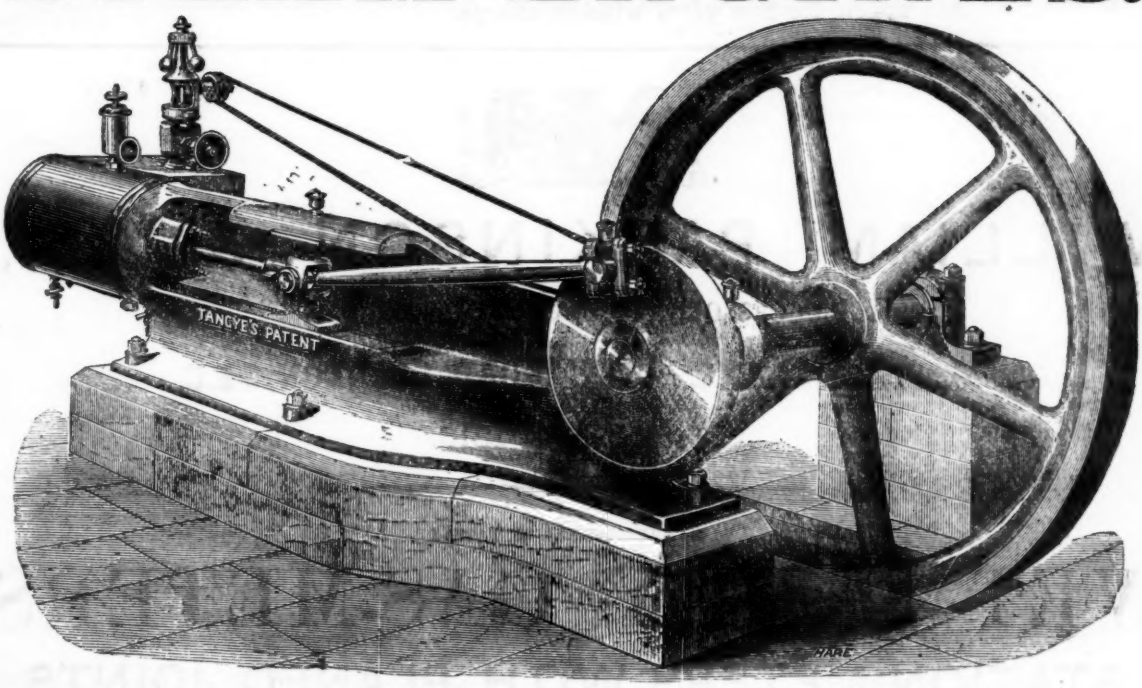
These Governors have been adopted by several leading Gas Companies, among whom are the following:—

The Gaslight Company—two 36 in. at Blackfriars.
" " a 36 in. at Goswell Road.
" " a 24 in. at "
" " a 24 in. at Whitechapel.
" " an 18 in. at Bow Common.
" " a 24 in. at Beckton.
" " a 6 in. at "
The London Gas Company—a 24 in. at Nine Elms.
" " an 18 in. at "
" " an 8 in. at "

The Exeter Gas-Works—a 24 in.
The Abergavenny Gas-Works—a 10 in.
The Birmingham Gaslight Company—an 8 in.
The Monmouth Gas-Works—an 8 in.
The Devonport Gas-Works—an 8 in.
The Cannes Gas-Works (France)—an 8 in.
The Mentone Gas-Works (France)—an 8 in.
The Rochdale Gas-Works—a 4 in.
The Imperial Gas Company, a 12 in at Great Cambridge Street.



TANGYE'S HORIZONTAL HIGH-PRESSURE EXPANSIVE
STEAM-ENGINES.



In this Engine the working parts are considerably reduced in number, as compared with Horizontal Engines generally, rendering it far more durable and compact. The bed-plate, front cylinder cover, cross-head guides, and plummer-block for crank-shaft bearing, are all cast in one piece, the cylinder with its valve-chest being bolted to the end of the bed. The cross-head slippers and connecting-rod ends are made adjustable, so that any wear can be readily taken up. The fly-wheel, cylinder-end, connecting-rod, and crank-plate, are all bright. All the parts are made to Whitworth's Gauges, and the material and workmanship are of the highest class throughout.

The Governor is of a very special description, and combines in the small space usually occupied by the ordinary steam stop-valve, a governor, throttle-valve, and stop-valve complete. It is exceedingly sensitive, simple, and compact.

Number	B	C	D	E	G	H	J	K	M
Nominal Horse Power .	2	3	4	6	8	10	14	18	25
Price of Engine . . .	£32	£38 15	£46	£70	£90	£115	£145	£185	£200
Feed Pump, extra . .	£3	£3 15	£4	£5 10	£6	£7 10	£8	£10	£15
Diam. of Steam Cylinder	4 in.	5 in.	6 in.	8 in.	9 in.	10 in.	12 in.	14 in.	16 in.
Length of Stroke . .	8 "	10 "	12 "	16 "	18 "	20 "	24 "	28 "	28 "

These Engines are adopted in Gas-Works at Haggerston (Independent Gas Company), Nine Elms (London Gas Company), Falmouth, Harrow, Jersey, Plymouth, Richmond, Rochdale, Santiago (Chili), &c.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

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1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

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WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

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THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 5, 1875.

Circular to Gas Companies.

THE year which has just passed away has been undistinguished by any great discovery in connexion with our industry, and even by any strikingly ingenious application of known principles. Our pages have, however, borne witness to the continued progress of invention; and some of the improvements we have had to record will, we expect, bear good fruit in the future. If there has been nothing of distinction in the way of discovery, we have, happily, had nothing to record in the way of harassing legislation. There were many who, at the commencement of 1874, expected that the gas industry would rapidly return to its normal condition. They thought, and indeed correctly, that the coal famine was past, and they hoped that our raw material would soon return to its former price. Such hopes have been dispelled. Coal, it is true, is cheaper than it was two years ago; but it has not returned, and never will return, to old prices. In the early part of the year some companies and Corporations, who had up to that time refrained, were compelled to raise the price of gas, and to this day we have had but few reductions to announce. Looking forward, as well as we can, to the prospects of the year just begun, we see at present no indications that the cost of coal will be much, if at all, lessened. The probabilities are in favour of a rise. We must wait, however, for spring quotations before we shall be able to form any opinion as to what the cost of coal will be for the year. In the meantime, gas companies will hesitate to make reductions in price where they can be avoided. No notice of application for another revision having been given, the prices of the Chartered and Imperial Companies revert to their statutory maximum, 3s. 9d., at which they must remain throughout the year. Some other small reductions may be expected in the metropolis; but, on the whole, we are inclined to think that the companies will not find themselves justified in making any considerable alterations.

The past year will be memorable for the renewal of an agitation which, arising like a commercial panic at pretty regular intervals, has in past times threatened the interests of the metropolitan gas companies, and to-day seems to imperil their very existence. There is a growing desire on the part of local authorities to acquire gas and water undertakings, and some of considerable importance will probably pass this year into the hands of Corporations. In the metropolis, however, the interests involved are so enormous, that, in the absence of a complete municipal organization, the future of the London companies may still be assured, if they remain true to each other. What progress has been made towards arriving at a general understanding we do not know. We hear of meetings, but the results have not transpired. It is now time that a definite course of action was determined upon, and we hope soon to learn that all difficulties and jealousies have been smoothed away, and that there are no longer any obstacles to united proceedings.

As it is, we can only show the position taken up by the companies by the measures they are promoting, and we continue to-day our notices of their Bills.

The Bill of the Imperial Company is to obtain, first of all, power to raise additional capital to the amount of £1,300,000, the dividends on which are to be limited to 6 per cent. or 7 per cent., according as the money is raised by the issue of preference or ordinary shares. As regards borrowing power, the company seek authority to raise at once £108,000, and in respect of the new capital, they desire to have power to borrow to the extent of *one-third* of the capital as it is issued, and under the usual restrictions. We shall by-and-by hear what Lord Redesdale has to say to this proposal. His lordship has hitherto rigorously limited the borrowing powers of a gas company to one-fourth of the capital authorized, for what reason is only known to himself. The letter of Mr. Farrer, suggesting to gas companies, that they should avail themselves of borrowing powers to a greater extent, may possibly induce his lordship to relax the rule he has laid down, and, until now, acted upon. Most certainly the advice contained in the Board of Trade letter has not been thrown away. The wish of the Chartered Company to obtain unlimited borrowing powers, and now of the Imperial Company to borrow to the extent of one-third of the new capital issued, evinces the earnest desire of the gas companies to fall in with official advice and popular demands.

There is a great deal to be said on the question of borrowed money and capital; but, as little (probably) will turn upon it in the coming session, it might now be passed over. To the permanent officials of the Board of Trade, who have never had the smallest practical experience in the management of a commercial undertaking, the matter presents itself in the simplest light. The choice between borrowed money at 5 per cent., and capital at 10 per cent., seems to offer a clear gain of 5 per cent. to the advantage of the public. On the other hand, we believe that there is no such incentive to extravagance in management as an unlimited command of borrowed money; and from one point of view we must confess that Lord Redesdale is right when he limits dividends, and contracts the borrowing powers of companies. The soundest undertakings (we here make no special allusion to gas companies) are those which have no borrowed capital at all. It is in such cases that the motives for economic management are strongest.

Passing on, however, we see that the Imperial Company propose to limit the dividend on borrowed moneys converted into capital to 5 per cent. After this, the company seek for power to amalgamate with any, or all, of the metropolitan gas companies, except the Chartered Company, and with this object they adopt the amalgamation clauses of the City of London Gas Act, 1868.

The Phœnix Gas Company, in the Bill they are promoting, do exactly the same. Their Bill may be dismissed very briefly (it consists of only three clauses), inasmuch as it is simply to confer on the company power to amalgamate with any or all of the eight companies now supplying gas in the metropolitan district south of the Thames. The Bill, if passed, will give the company power to submit to the Board of Trade a scheme, under the provisions of the City of London Gas Act (which are incorporated), for amalgamation; but, before this can be done, the company must have come to terms with the other companies with whom they hope, wish, or expect to amalgamate. They have recently, we believe, had a conference with these companies, and we sincerely hope that a common understanding has been arrived at, by which we shall be spared the sight of a struggle between companies whose interests, we may say, would be best promoted by combination.

It should be mentioned here that the Bill of the Phœnix Company adopts the revision clauses of the Act of 1868; but why, it is hard to say. No alteration is made in the illuminating power of the gas, which may still be 12 candles; nor in the price, which may be 4s. 6d. and 5s. 6d. per 1000 feet, except as the price and quality may be varied in the special Acts of the companies with whom power is sought to amalgamate. Doubtless, any scheme submitted to the Board of Trade would be explicit enough, but this Bill seems to have been drawn in a hurry, with simple reference to amalgamation.

The Bill of the Commercial Company is a much more elaborate affair. One chief object, as our readers know, is amalgamation with the Ratcliff Gas Company, which it is proposed shall take place on Jan. 1, 1876. Further than this, the Bill authorizes the Commercial Company to raise additional capital to the amount of £450,000, with borrowing power to the extent of one-fourth of the capital raised. It is rather curious to note that the Bill follows exactly the lines of the Chartered Company. The minimum illuminating power of 16 candles is adopted, and the maximum price is 3s. 9d. per 1000 feet. That being so, the company hope that, like the Chartered Company, they may be allowed to divide 10 per cent. on the additional capital.

It is hardly necessary to say that the Bill includes all the provisions of the City of London Gas Act, 1868, relating to the appointment of referees and their functions, of a gas examiner and a chief gas examiner, and last, but not least, the provisions for a revision of price, in case 3s. 9d. will not yield 10 per cent. For the rest, all necessary enactments are proposed for the absorption and dissolution of the Ratcliff Company, with the compensation of officers, as agreed upon between the directors. The two companies are to unite on perfectly equal terms, saving the rights of preference shareholders in the Commercial Company. There is nothing more that requires notice, except, perhaps, a form of contract with a consumer which is scheduled. According to this, the consumer contracts to pay, at the stipulated rate, for all gas registered, and, if the meter should cease to register, for a "reasonable proportion" during the period of such non-registration. With whom it may rest to decide on what is a "reasonable proportion," the Bill does not say, so we may suppose it will be left, as before, to a magistrate.

The fate of the three Bills here noticed, and that of the Chartered Company we have mentioned before, will, of course, depend first, on the action taken by the Government through the Board of Trade, and next, on the proceedings adopted by the two metropolitan authorities. If the latter should persist in their scheme for the purchase of the companies, and should be successful, neither of these bills would be required; and, failing this, if the Government should insist on some measure for a general amalgamation, a more comprehensive scheme must be substituted for those now under consideration.

The ratepayers and gas consumers in the out-districts around Birmingham are stirring on the gas question. There seems to be an uneasy feeling that by getting possession of the gas-works the Corporation of Birmingham will obtain some unfair advantage over the surrounding local authorities; that, in fact, the out-districts will be taxed for the exclusive benefit of Birmingham. The suspicion we believe to be unjust. The consumer will have to pay the Corporation for gas, just as he paid the company, and that is nearly all the difference. That the Corporation will desire to make some profit we have too much fear; but there seems to be, at all events on the part of the mayor, a disposition to make a fair partition of whatever surplus profits may be realized. How it is to be made is not yet clear, and the Wednesbury Local Board are not quite satisfied. There is at each Local Board a talk of purchasing the plant lying within the district; but the Mayor of Birmingham, while not positively objecting to the sale, would rather not dispose of any part. The tempting statement he put before the ratepayers was based on the calculation that the undertakings would remain with the Corporation in their integrity. A time may come when the growing wants of Birmingham proper will have to be met in one of two ways—by large extensions of works, or by contracting the supply to the out-districts. Then will come the opportunity of the outlying Boards, and we should advise them to wait with patience, taking steps now, however, to obtain power to purchase, and most certainly to have a maximum price fixed by the Corporation Act.

The gas undertaking of the Corporation of Leeds has been carried on for the past year at a considerable loss. Gas is sold for 3s. 9d., which is about 6d. less than it costs. The Town Council are naturally anxious about the matter, and are casting about for the means of remedying this disastrous state of affairs. Among the proposals made, is one which, we must say, has a rather droll look. It is suggested, that three sub-committees should be formed, and that each should take in hand one of the manufacturing stations, and see which can produce gas cheapest. This sort of competition among sub-committees is certainly an original notion; but we venture to think that no satisfactory result is likely to follow. If the Town Council have no confidence in their officers, they had better change them. To take the conduct of a station out of the hands of the responsible manager, and confide it to a few gentlemen innocent of all knowledge of the art of gas-making, would be sheer folly. We have intimated before, the probability that some of the Leeds works want overhauling, as do, no doubt, the mains, &c. There is now, it seems, a leakage of 19 per cent., which is excessive. The council had better take the advice of their officers, and make a liberal expenditure in putting things to rights, and in a year or two their accounts will tell a different tale.

As regards gas supply, circumstances in Hull are not unlike those in the metropolis. Three several companies supply separate districts, each with a different quality of gas, at a different price. The charge of one company—the British—is exceedingly low; that of the others may be considered moderately high. There can be no wonder, then, at the dissatisfaction of the inhabitants in the more highly-rated districts. The Town Council now have the matter under consideration, but we do not see how they can remedy the grievance, unless they purchase the undertakings, and establish uniformity of price and quality.

Water and Sanitary Notes.

In Dr. Frankland's monthly report on the metropolitan waters, we are bound to say that he supplies a sufficient answer to the question we put in our last, and gives ample reason for considering the Chelsea water unfit for dietetic purposes. We do not care much for living and moving organisms, nor for the myceliums of a fungus; to the reports of previous sewage contamination we pay no attention at all; but when we come to half-digested muscular fibre, the evidence of contamination with recent fœcal matter is conclusive. We do not for a moment defend the distribution of such water, still we may point out that no ill effects seem to have followed the necessarily extensive use of it. We are glad to see that the directors of the Chelsea Company have already acquired the land for impounding reservoirs near Molesey, and we hope that nothing will happen to interfere with the rapid execution of the works.

There is likely to be a severe competition for the water from Ullswater Lake and Haweswater. Mr. Bateman has devised a scheme for supplying Manchester and Liverpool from these sources, and, as our readers have been already informed, a plan has been elaborated for taking the same water to Newcastle and Gateshead. There seems to be little disposition on the part of the sanitary authorities in East Northumberland and Durham to combine to form a joint water authority. The necessity for this is not sufficiently apparent, and perhaps will not be for another quarter of a century; but it is quite clear that if we continue to increase at our present rate, and if the physical changes now in progress are continued, it will, in time, be absolutely requisite for districts to combine for the appropriation of their respective watersheds. The Northumberland Lake scheme of Mr. Bewick does not seem to find favour in Gateshead. The water is said to be peaty, and town populations do not like brown water.

The Corporation of Leeds having constructed works, which are, no doubt, admirably adapted for the treatment of sewage by a precipitation plan, are now in search of a process. They have tried the A. B. C. method, and obtained, according to the report we published a week or two ago, some apparently useful manure, which they used on their farm. The cost of it was, however, rather large; and neither the Native Guano Company nor the Corporation saw their way to making a profit. The

company were, therefore, released from their bargain; and the Leeds sewage works are at the disposal of any one who will be at the expense of making experiments. Just now they are in the hands of a company who are working a process, to which we have often seen allusion made; but as we take no notice of secret processes, we have never mentioned that of Messrs. Goodall and Fulda. To-day, however, we have the ingredients used by the inventors, and may speculate on the value of the process. It is the old story of lime, charcoal, and town ashes, with the addition of a persalt of iron. Now here are a number of ingredients each one good in its way. Lime and charcoal we know to be useful, and town ashes will help to carry down suspended matters. The persalts of iron are good deodorizers and antiputrescents. But when the inventor comes to grind his "sesqui-persulphate of iron" with lime and ashes, he gets a mixture of sulphate of lime and peroxide of iron, and loses, we take it, the most important effect of his two chief ingredients. No doubt the process yields a tolerably clear effluent; all such processes do if there be only sufficient time for subsidence. The cost of treatment, however, is high, and we fail to see that the process possesses any special recommendation.

WARNER AND COWAN'S PATENT DRUM.

In another place will be found the specification of Messrs. Warner and Cowan. The improvement in gas-meters patented by these gentlemen requires more than a passing notice. The changes effected in the construction of the wet meter are such that it now occupies a position which it never held before—that of an unvarying measure. It will be understood by this that, hitherto the wheel or drum has not been, within itself, of unvarying capacity.

The fluctuations in the water-line being the cause of variation, much attention would be given to this, it might be supposed, in the earlier periods of the history of the meter; and such was the case. A Mr. Hemming, between 30 and 40 years since, patented the application of a fountain to the ordinary wet meter, but Malam had before applied it to his undulating meter. This idea passed through many changes and modifications, till it left the hands of Messrs. Esson and Cowan some years since as the best compensating meter. The next appliance for the purpose was the float of Messrs. Sanders and Donovan, for forcing the water to the drum by displacement in an extraneous vessel. Following this are the mechanical appliances, revolving and reciprocating scoops for lifting the water. All these appliances were for the same purpose—the maintenance of the water level within the wheel, to obtain correct measurement.

For years, however, we have held the opinion that the drum, being the measure, should have such a form, or be so constructed, as to be unaffected by the water level. Clegg's and Bartholomew's meters, though it was said they accomplished this, gave no indication of the idea being realized. The principle here, indeed, is but that of the others we have referred to—the maintenance of the water-line within the measure. These meters must, therefore, all be placed in the same class—a uniform measure by a uniform water level.

Mr. W. Richards appears to have been the only one who practically aimed at it; but his wheels, though exceedingly ingenious, and indicative of much study, and of a thorough knowledge of the principle upon which the wet meter is constructed, lacked, we may almost say, any approach to a new principle in construction. His efforts rather tended, as those of the late Alexander Wright were directed, towards modifying or reducing the loss through enlargement of measure by the lowering of water level, than to a change of principle in construction, "the measuring chambers" being "reduced, at or near the water-line, to the smallest capacity consistent with the effective working of the drum."

The father of one of the patentees of the present invention, the late Mr. Cowan, of Edinburgh, many years since (1844) made a more direct attempt, by constructing an annular wheel with four chambers, but the idea was abandoned after it had been protected and much time and money expended. In the construction of a simple annular wheel there would have been no new principle, nor would there have been either a uniform measure produced. The capacity of the chambers proper of a wheel are not the only parts that affect the measurement; the gas-ways into and from the chambers, the hoods, forming a part of the chamber, are likewise affected with it by change of water-line, and, consequently, affect the measurement. This cause of variation appears to have been overlooked by writers on the subject, as well as by experts in construction. Thus, in the attempts to lessen the variation, by shortening the axis and increasing the diameter, one portion of the wheel, it may be said, was improved at the cost of the other; for, as the variable area of the chamber proper was reduced, the hood openings became enlarged or lengthened by the increased diameter of the wheel. This is no fanciful element, as will be seen by looking at the proportions of wheels as given by Clegg:—2-light, diameter 9 in., depth of inlet-hood 0·28, and outlet-hood 0·43. Hitherto no attempt has been made to touch this cause of variation, nor can it be modified by any change in the relative proportions of the several parts otherwise than has been pointed out. It must be borne in mind, too, that these gas-ways are water-ways as well, and it is necessary, for the freedom of action of the water, that the *rate* of the *current* of *water*, as displaced, should *not* be increased.

It is evident, then, that for the wheel to be made a *perfect* measure *within* itself, the variation in capacity of the hoods as well as chambers must be dealt with, and that neither the flow of gas nor water must be impeded. These objects are very beautifully attained by the patent drum of Messrs. Warner and Cowan. The mechanical action of the drum is precisely the same as the ordinary wheel—a cylinder revolving on a shaft or axis—but, the gas delivered to the consumer, is a constant volume with a variable water-line, against a variable volume with a variable water-line. The gas, however, delivered *into* the chambers of the drum is a variable quantity, the same as into the chambers of the wheel; but the excess of volume, instead of being allowed to pass on to the burner, is abstracted, and conveyed back to the common inlet. The measurement, then, may be said to be effected by two operations, a positive or plus, and a negative or minus action. Both volumes, the plus and the minus, are variable, and vary with the water-line; but both are *equally* affected by change of water-line; therefore, as the minus increases directly as the plus does, the *net* volume measured and registered is practically unvarying.

By reference to the specification, it will be seen how admirably the *two* causes of variation are dealt with. Within the drum is placed a small wheel, the same in construction as the ordinary wheel, but with the hoods and partitions arranged so as to pass the gas from the back to the front; this small wheel takes its supply from the *filled* chambers of the drum. As both drum and wheel are equally affected by change of water-line, no alteration of one will be made without an equivalent alteration of the other. A fall in the water-line will increase the capacity of the chambers of the drum, and, of course, increase the volume; but, by the same lowering of the water, the capacity of the chambers of the small wheel is equally increased, and hence the excess of volume is returned to the inlet of meter. The depth of the small wheel, it will therefore be assumed, is half the depth of the drum. It is, consequently, divided into two parts, to the extent of the diameter of the small wheel, the periphery of which is rather above the water-line of the meter. Half, then, of the ordinary variable portion of common drum is occupied by the small wheel, and so is unaffected by change of water level; the other half *is affected* by the change of water-line, but as the capacity of the wheel is equal to the variable portion of drum, and is fed from it, it follows that any excess of volume in the drum is withdrawn by the small wheel, as the variable portion of drum and wheel are equal, and equally affected by change of water level.

We said the variable portions of drum and wheel are *equal*, but this is *not so*; the capacity of wheel is greater. Here we see the beauty of the invention. It is greater, because there is the compensation required for the hoods, which is met by this apparent increase of minus quantity. Such control is thus obtained over the measurement that the effect of change of water-line may be entirely reversed, the meter getting faster as the water is lowered. Thus the consumer may be made to have a direct interest in the supervision of the inspection of the meter. Both company and consumer are now equally protected, perfect accuracy of measurement is obtained, and that, too, without the least increase of mechanism, or the action of the meter in the least degree being prejudicially affected.

THE MANN AND WALKER'S PATENT SCRUBBER.

Mr. William Mann, the engineer of the City of London Gas Company, was the first inventor and patentee of a Scrubber, by the working of which, the small quantity of clean water necessary for the total absorption of all the ammonia present in the gas after condensation, could be supplied in a constant stream, and presented in a peculiar state of division to the foul gas, also properly divided, so as to effect a perfect purification from ammonia, and at the same time a source of profitable revenue to a gas company.

There has, probably, been no object so much desired in the manufacture of gas, nor one in which so many experiments have been tried, as this—not only to purify from ammonia, but also, at the same time, to obtain the residual product in its most profitable form. For this purpose the quantity of water to be used must be the very smallest possible for the complete absorption of all the ammonia contained in the gas. The complete purification from ammonia is to be desired, not only for its profitable return, but also because, if the quantity left in the gas is at all excessive, it lessens its illuminating power, and is very destructive to the consumers meters and gas-fittings generally. The quantity of ammonia contained in coal varies considerably. The coals of the midland counties, and of Yorkshire and Lancashire, frequently are found to contain from 30 to, in some cases, 45 per cent. more ammonia than Newcastle gas coal.

The excessive quantity of this valuable product was formerly regarded as a great nuisance by gas companies, the old Washer—long since, from its inherent defects, gone entirely out of use—with the gas bubbling up through tar and liquor, being utterly ineffectual to arrest ammonia, especially where it abounded so largely; the gas passing in globules the size of a marble, or, when excessive pressure existed, of the volume of a cricket ball, unaffected, except externally.

The ammoniacal liquor washing scrubber, which succeeded the washer, was an important step in advance; but it is quite impossible to purify gas from ammonia by its use, and in Lancashire and Yorkshire and the midland counties, where, as we have remarked, the coals are rich in ammonia, it is found, that when scrubbers of this kind and of the best form have been used, frequently 30 to 35 per cent., and in some cases more, of the ammonia escapes past the scrubbers to the purifiers.

The changing of the purifiers in these circumstances is most distressing to the workmen engaged. Indeed, it is within our knowledge that managers of gas-works, from humanitarian motives alone, have induced directors to incur an outlay exceeding the cost of the perfect scrubbers we are about to describe, upon additional purifiers, to be worked with sulphuric acid and sawdust, or other chemical

ingredients, so as to arrest the ammonia before reaching the ordinary purifiers, and thus avoid its pungent distressing effects upon the eyes and mucous membrane of the men engaged in working them.

The usual practice, especially in the northern parts of England, gradually became, to wash the gas with ammoniacal liquor in the kind of scrubber referred to, and to rely on the use of chemicals in the after purification for absorbing the ammonia, and, indeed, this practice prevailed until very recently in some of the metropolitan gas-works.

The manufacturing chemist prepared the ingredients at his establishment; from thence, where canal carriage was available, the ammonia-absorbing material was conveyed to the gas-works. In most cases, however, it had to be packed in bags or casks, conveyed by horses and carts to the railway station, thence carried 50 or 100 miles, then unloaded from the railway trucks into carts, and carried to the gas-works, where again, by hand labour, it had to be unloaded and carried to the side of the purifiers. Then followed the hand labour of charging and discharging the purifiers over and over again, until the material became sufficiently charged with ammonia to make it profitable to the chemist, to whom it was then returned, when all the hand labour, packing in bags or casks, had to be repeated, conveyance by horses and carts, railway, or canal, &c., &c., to the chemical works.

As a matter of course, in most instances, the gas company got nothing, besides being at the expense of additional purifying surface, and of labour in working the same. The chemist delivered the materials, and fetched them away, when fully saturated, relying for his profit on the sale of the residual product after all the necessarily heavy expenses incurred were paid.

It is obvious, therefore, that if a Scrubber could be constructed in which, by the use of a little of the cheapest element—water—the whole of the ammonia contained in coal gas, hitherto such a burden and trouble to remove, could be absorbed, it must necessarily prove of considerable advantage and profit to a gas company, and these advantages become considerably increased where a gas company determines, as in so many recent cases, to work up the residual product into sulphate of ammonia themselves on the works.

The Gas Referees, in their report to the Board of Trade, confirm this view of the question, stating that the most advantageous form in which a gas company can remove the ammonia is the liquor form, "not only because this would save labour required for changing the trays of sulphate of iron, and the sulphuric acid purifiers, but also because the ammonia yields a better return in the form of ammoniacal liquor as obtained from the scrubbers than when the above-described supplementary processes of ammonia purification are employed. It is advantageous to do the work of ammonia purification wholly by scrubbers."

It is worthy of remark, also, that the Gas Referees, in their report to the Board of Trade, entirely dispose of the erroneous idea existing in the minds of many managers of gas-works, that the contact with clean water, in a moderate amount, was detrimental to the illuminating properties of gas, by the practical experiments they made upon this question; although such a question would scarcely bear in the smallest degree upon these scrubbers, the quantity of water being so very small, and becoming changed to ammoniacal liquor within a few feet of its admission into the apparatus.

To remove a large portion of the ammonia contained in coal gas, as will be seen from our remarks, is comparatively easy of accomplishment. But to effect a *complete absorption* and a *profitable residual product* was by no means equally easy. Many ideas and experiments, by very able men, have been tried with only a moderate amount of success. Modifications of the old washer system have been adopted; also improvements of various kinds in ammoniacal liquor washing scrubbers; many ingenious manipulations of the spray system of Mr. Goldsworthy Gurney, described in Clegg's "Treatise on Coal Gas," 1859, which has defeated all efforts to maintain the form of fine spray, the least particle of tar or naphthaline on the button at once spoiling its effect; different methods of charging scrubbers with brickbats, broken bottles, stones, bricks, drain-tiles, and materials of a more dense character to finish with; but all have ended in the resort to some expensive supplementary process of chemical ingredients in purifiers to complete the purification.

It is remarkable that, even with scrubbers drenched with clean water, dashed in in large volumes, ammonia will pass to the extent of from 10 to 20 grains per 100 feet, according to the quantity contained in the coal, the natural tendency of gas to assume a globular form, and bubble through the liquid unaffected, defeating all efforts at purification in this direction.

The most perfect process of ammonia purification is that which does its work with the least amount of water, and such process must be constant, not intermittent, in its action; otherwise, with the coal we have described, abounding in ammonia, a large portion must inevitably escape past the scrubber. A perfect purification, therefore, cannot be obtained unless the *water* be *divided* or *broken up* in a *particular way;* and the *gas*, also, must be *broken* and *divided* in a *particular way*, to *meet the water*.

Some time since, Messrs. Walker, of Donnington, who had been extensively engaged in the construction of scrubbers of many kinds, joined with Mr. Mann, to assist him to improve his scrubber, and, by perfecting the details of all the parts, to more thoroughly increase its purifying power.

All the parts of the scrubber from the bottom to the top, with its machinery, were revised and experimented upon. The internal construction was improved so as to effect a redistribution of the liquor several times during its descent, discharging itself directly it reached the bottom of the scrubber.

The scrubber was perfected to make it perform its work efficiently with every variety of coal used in Europe. Several important inventions were added to the machinery. By these means the purifying power of the scrubber was found to have increased 50 per cent., and its action rendered certain. All the improvements were secured by patent in the various countries of Europe, and the United States of America.

Good condensation is absolutely necessary with these scrubbers (for gas must be cool before it can be purified), without which they cannot be effective. The process being in its nature of a clean character, the condensation should be sufficiently good to keep back all thick tarry matter. The working of the scrubber is then easily managed, so that ammonia shall never be permitted to pass to the outlet. It should indeed be regarded in exactly the same light as the presence of sulphuretted hydrogen on the outlet of the purifiers.

Foul gas, thus properly condensed, and brought to the inlet of the scrubber, of the ordinary temperature of about 60° Fahr., is by *once only passing through the* scrubber *completely purified* from ammonia with certainty, and without any further trouble or supplementary process; and the liquor resulting from a small quantity of clean water let into the machinery at the top is discharged from the bottom of the scrubber, if from Newcastle coal, at about 20 oz. strength; from Yorkshire and other coals the liquor is generally from 25 oz. to 30 oz. strength, the relief of the purifiers in the after purification being very great indeed.

The absorption of the ammonia is most complete; the reports of the testings made by analytical chemists in many different countries, at the *outlet close to the scrubber* itself, being ½ grain, ¼ grain, and frequently "none," day after day.

Many of our readers entering London by the South-Western Railway will, no doubt, have had their attention arrested by the powerful Mann and Walker's scrubbers at the London Gas Company's works at Nine Elms. These gas-works, of which Mr. Robert Morton, C.E., is the engineer, are of the first magnitude, producing over five million cubic feet per day. The scrubbers are each 18 feet in internal diameter, and about 75 feet high over all, containing six columns of coke, arranged for the rebreaking up and redistribution of the liquor as it leaves each column. The bottom of the scrubber discharges the liquor directly it reaches the lowest part. A full-page engraving of these scrubbers is given with the present number of this JOURNAL.

On the top of each scrubber is an iron-house, which contains the reservoir of clean water, and the machinery, gearing, &c. A small quantity of this water is admitted from the reservoir into the machinery, which is worked by differential eccentric gearing. Here it is broken up into that state of division most effective for absorbing ammonia, and so distributed over the internal surface of the scrubber. The use of coke is never departed from in these scrubbers, its porosity being valuable for retention of water, and its surface being full of small cavities, the water lodges therein, and thereby comes in contact with the gas. When it is taken out after a long period of time, it is used for fuel for heating the retorts, and therefore costs the gas company little beyond the labour of moving it. The scrubber gives no back pressure, the gas passing freely through. The action and effect produced is generally about as follows:—

The small quantity of clean water becomes changed almost immediately to ammoniacal liquor of about fully 1 oz. strength in the first column of coke.

At the bottom of the next column it has become fully 2 oz. At the next it is of 4 oz.; at the fourth it is of 8 oz.; at the fifth it is of about double this—namely, 16 oz., and it is discharged at once on reaching the bottom at about 20 oz. strength, the whole of the ammonia contained in the coal being completely absorbed by the gas *once only passing through*.

The amount of machinery used in the operation is considerable; but the speed at which it travels is so slow, that a very small amount of power is required to work it, the wear and tear from the same cause being very little. This power is obtained from a small horizontal steam-engine, contained in the wooden box seen at the bottom of the second scrubber where the man is at the door, the power being conveyed by a vertical driving-shaft to the horizontal shaft carried along the top of all the scrubbers, from which the machinery of each derives its motion.

The machinery rooms are united by a gallery running from end to end, and the staircase for ascending is seen in the drawing. The cost, indeed, of the power is merely nominal, as a small tube from the steam-boilers, always in use in gas-works of this magnitude, gives power to the small steam-engine. These patent scrubbers were erected, under guarantees for their full efficiency, by the Messrs. Walker, of Donnington.

Their working results have been highly satisfactory in every respect, the guarantees given having been more than fulfilled, mainly, it is only just to remark, by their working being under the direction of the staff of experienced officers of the London Gas Company, by whose skill and attention the successful development of the working power of these scrubbers was speedily and fully attained.

Since these scrubbers were erected at the London Gas-Works, many have been constructed, as shown on the annexed engraving, having the house on the top surrounded by a circular gallery, which enables the staircase to be connected at any point in the circumference, or from any adjacent building or landing. It answers very conveniently for connecting several scrubbers together, and enables any part of the house to be conveniently got at. Scrubbers of this kind have since been erected by Messrs. Walker at some of the largest provincial towns, and in some of the chief cities of Europe, and in London they are in the course of construction at the Phœnix Gas-Works and Surrey Consumers Gas-Works.

They are being used on the largest scale at the New Beckton Gas-Works; and it is only fair to state that these scrubbers owe their development and the success they have attained in purification mainly to the aid and encouragement given to them by Mr. F. J. Evans, C.E., of The Gaslight and Coke Company—a gentleman, who, in addition to his eminent engineering abilities, possessing a deep knowledge of the practical chemistry of coal gas, was the first to discern their merits, to aid and encourage every improvement made in them, and to adopt them on an extensive scale.

Correspondence.

PURIFICATION.

Sir,—It is with some reluctance that I again trouble you with a communication on this subject; but the interests of the profession, as well as a sense of justice to myself, seem to me to demand it.

Mr. Newbigging (I regret having to refer to it), in his reply to my letter, at page 730 of the Journal for 1st ult., characterizes as absurd certain statements advanced by me, while the fault lies more in his own want of perception, induced, perhaps, by a lack of patience while reading over my communication.

Mr. Newbigging at the outset refers to the hygrometric condition of coal, and states that certain blame would attach to the management wherever moderately dry coal was not employed (in gas manufacture), seemingly ignoring any difference in the natural condition of coals as regards water. But for the sake of argument let us suppose the case of two gas companies—viz., company No. 1 is situated in the centre of a field of, say, cannel coal, which naturally holds 12 per cent. of water (a common case), and which, on account of its cheapness as compared with others at a greater distance, this company exclusively or to a large extent purchase. Company No. 2 is situated also in the neighbourhood of a coal-field from which they wholly, or to a large extent, purchase their supplies; but in this instance the coal naturally holds only 4 per cent. of water, in virtue of its being more compact, or less porous; thus, therefore, the relative initial amounts of hygrometric water in these coals are as 12 to 4 per cent., and in the use of which, either in this condition or after partial drying by ordinary storeage for six months, similar proportions of carbonic acid would be produced, and have to be removed chiefly in the purifiers, and by lime. Now were both companies thus situated to consult Mr. Newbigging regarding the renewal and extension of their purifying apparatus, would he allow us more purifying surface per 1000 feet in the one case than in the other, or would he allow an equal area in both cases, and afterwards blame the management with the defective power of the purifiers in the case of company No. 1? Let the above suffice to explain the meaning of my expression, "moderately dry coal."

Mr. Newbigging is at a loss to know the reason why I left so much as 2 square feet of purifier area per 1000 feet, for the removal of sulphuretted hydrogen alone, instead of about one and a half foot; but I did not think it was necessary to inform him that a larger area is required in the use of oxide of iron than in that of lime.

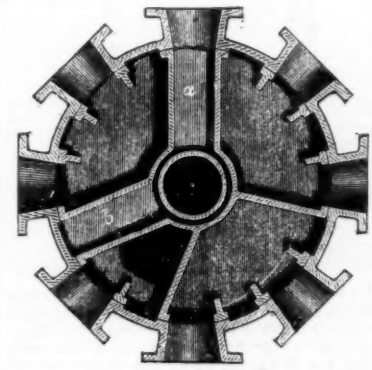
With regard to the impurity which Mr. Newbigging alleges to have been understood, in connexion with existing rules, for determining the required area of purifiers, such may have been understood by their devisers; but if considered of any importance, as it really is, why is it not stated for the guidance of others?

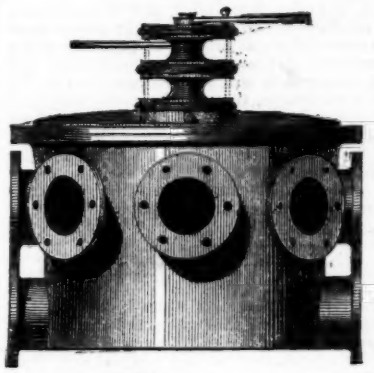
It is quite evident that Mr. Newbigging did not carefully read over my letter before writing his, or surely he could never have gone so far as he has to disprove points or statements never advanced, since he administers correction for an alleged statement, that "the per centage of impurity in the foul gas must alone be taken to determine the area." Such a statement would have been absurd enough, but if he will again (and with more patience this time) read over my remarks, he will find that "impurities to be removed, and volume together," are the words used. And, again, with regard to number of purifiers, he gets into the same error, in making it appear as if I refer to the power of the purifiers when speaking of the 24,000 square feet in six sets of three purifiers, each 36½ feet square, as a more profitable arrangement than his 20 sets of three each, giving the same gross area. If in the proper and pecuniary sense Mr. Newbigging fails to see any difference between the two arrangements, I beg to assure him that there is a very important one, and it may surprise him to know that the increased cost of such a number of purifiers of small area, as compared with the smaller number of large area, would amount to from 20 to 25 per cent. for land and material together; and I am sure if he will devote a short time only (say, half an hour) to the calculation, he will be able to satisfy himself. But, having obtained his views upon the subject, very important light is thrown upon question of capital required, as also the profits to yield a return upon that capital. And here the inadequacy of the profits referred to by me is partly accounted for, but which, moreover, I append to the excess of power over that presently employed, and not to the entire purifying plant. Again, Mr. Newbigging evidently has got a capacity for large mercies only—probably for 12 or 15 per cent.; whereas few holders of gas stock, with the exception of "originals," get more than 5 or 6 per cent. The above will, I think, suffice to fully account for the discrepancy in our respective calculations.

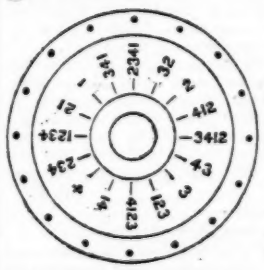
Paisley Gas-Works, Dec. 24, 1874. Geo. R. Hislop.

RECESSED CONE VALVES FOR PURIFIERS.

Sir,—Referring to your "Treatise on the Manufacture, &c., of Coal Gas," in which the author, speaking of purifier valves, forcibly indicates the advantage of a system of valves to work a set of four purifiers together, I desire to call attention to the patent recessed cone centre-valve, which is specially and peculiarly adapted to the purpose, while it is not open to the objections noticed as common to centre-valves generally.







One of these valves is made to work four (or any number of) purifiers all together, in various order of succession, and to bye-pass any of them at discretion.

Both the cone and body of the valve are "recessed" in such a manner that no part of the working surfaces is exposed to the gas, except at the moment of changing the course of the gas, which can be effected with rapidity and certainty, no gearing being required even for the largest valves.

For easing the cone, preparatory to altering the course of the gas, a short hollow screw is provided upon the spindle attached to the lower lever, which is limited by a stop to about one-eighth of a turn, sufficient to relieve the weight and friction of the cone, which is again tightened by the reverse movement of the lever, directly it has been shifted by the upper lever, which is keyed upon the spindle.

The current of gas is shown at all times by the index-plate.

The form and construction of these valves is strong and unyielding. All the working surfaces are accurately finished in the lathe, and will remain tight for any length of time.

When the branch, *a*, points to the inlet of either of the purifiers, the gas passes through three purifiers in succession by passing the fourth; and when the same branch, *a*, points to the outlet of either of the purifiers, the gas passes the reverse way through two purifiers only.

When the branch, *b*, leading from the central inlet is pointed to the inlet of either of the purifiers, the gas passes through all the purifiers in succession. When the same branch, *b*, points to the outlet of either of the purifiers, the gas passes in the opposite direction through that purifier only.

There are thus 16 changes to be obtained, which are accordingly shown on the index-plate.

It is impossible for any derangement or accident to occur from mistakes of attendants.

At least one purifier is always in connexion in any position of the cone.

Messrs. R. Laidlaw and Son, of Glasgow and London, are the makers of these valves, many of which are in use in the north, and some of large size have been in use since 1871.

I have recently fixed one of these centre-valves in connexion with four purifiers, in the manner above described, at Clyde Wharf, Victoria Dock, and other valves of this description, for bye-passing, &c., are in use at some of the metropolitan gas-works.

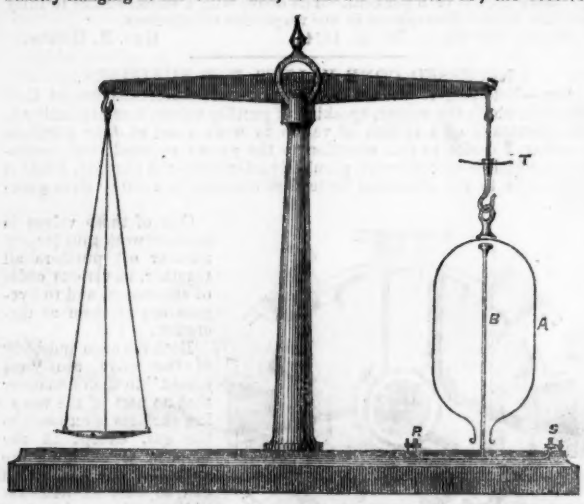
172, *Fenchurch Street, E.C.* Robert Porter.

SPECIFIC GRAVITY APPARATUS.

SIR,—There is, perhaps, no more difficult operation in manipulating with coal gas in the experiment-room than that for ascertaining the specific gravity. The very refined and delicate apparatus now available in different ways for determining the point, is not employed so extensively as might be expected, owing to the numerous sources of error which, without extreme care in practised hands, can scarcely be avoided.

Many years ago an apparatus, consisting of a light tin flask, containing some 50 cubic inches, was employed for enclosing alternately a body of air and of gas, the one displacing the other by a strong current of the required fluid being blown in at one aperture on the end of the flask and out at the opposite, and, when supposed to be filled entirely, light caps closed the apertures, and the flask was then placed on a balance, and weighed with its contents first of air, then of gas. Tables, correcting for pressure and temperature, being supplied with the apparatus the approximate density of the gas experimented on was ascertained.

I believe that with some simplification and better adaptation of apparatus, the flask process might still be found the most convenient and reliable method for determining the gravity. I should propose to employ a delicate balance, with scale at one end, and a light glass receiver constantly hanging at the other end, as shown on sketch A; the receiver



having an open aperture at its lower end, through which passes a standpipe, B, with discharging nozzles at top. R and S are respectively taps, by which air and gas can be passed into the receiver from small holders. The glass receiver filled, say with *air* first, being then delicately balanced by counterpoise, the gas is turned in to the flask until the whole air has been displaced, and when quite filled, and in suspension, it is only necessary to note carefully the amount of weight requiring to be placed in the scale, T, to restore the equilibrium; and thence—tables being calculated for the capacity of the flask, the temperature, and barometric pressure—the specific gravity will be determined as in the older arrangement, with this advantage, that by the mode suggested much more accurate balancing can be ensured, and the containing flask requiring no handling or moving about, the temperature of its contents, which could be indicated by a thermometer inside, would suffer no change while the experiment is being made. I think such apparatus would be welcomed by gas managers, if some of our skilful manufacturers would introduce a simple apparatus on this principle.

Edinburgh, Dec. 26, 1874. J. REID.

GAS MANAGERS ASSOCIATION FOR THE NORTH OF ENGLAND.

SIR,—Seeing that there are several district associations of gas managers (if I may use that expression) established throughout the country, and especially in Scotland, where managers are to be counted by tens as compared to the hundreds of England, and hearing a report some time ago about the formation of such an association for the Cleveland district, or perhaps, more properly, for the northern counties, I have been wondering whether any steps have been taken to carry out this object.

I think there can be no doubt that every one in the district must be satisfied of the desirability of such an association, in connexion with which the members could meet, say, quarterly, and discuss matters of interest and importance, for we all know that "in the multitude of counsellors is wisdom." I hope, therefore, some one will be good enough to take the matter up. I have no fear of its success, as I know that gas engineers and managers of this part of the country are as good and talented men as are to found elsewhere. S. E.

GAS MANAGERS BENEVOLENT-FUND.

SIR,—The suggestion of "A Young Gas Manager" assumes the form of an assurance scheme more than a benevolent-fund, intended to meet necessitous cases likely to occur among the smaller class of gas managers; and it is questionable if the idea of making a call of 5*s.* a member, in the event of a death, is an improvement upon the many insurance societies that are open to all. Although very indifferently responded to, the benevolent scheme of the "West of Scotland Gas Managers Association" has already done service, and it does not say much for the brotherly love subsisting in the profession, or the power to do good would have been largely augmented.

There are few situations more onerous and poorly paid than the manager of a small gas-work, where, for seven days a week and 16 hours a day, one man is stoker, collector, manager, and secretary. He is expected to be at the call of every consumer, who at the same time looks upon him as something worse than the tax-gatherer, and, of course, respect him accordingly. ONE WHO KNOWS.

EFFICIENT VALVES FOR PURIFIERS.

SIR,—Preparing plans for extensions, I intended to build a new retort-house, and to convert the old one, which, by taking away a partition wall, would be square, into the purifying-house; but, on reading the 41st chapter of the "Treatise on Gas Lighting," I altered my mind; for I want to have perfect control over the purification. Now Mr. Warner's letter in the JOURNAL of the 15th ult. has caused me to be undecided as to what plan to adopt. Would you kindly assist me to ascertain whether there is (to quote the words of the author of the "Treatise") any "requirement or mode of purification that cannot at once be met, with perfect ease and simplicity," as well by either Warner's "adjustable *centre-valve*" or Hollingshead's patent No. 1 *centre change-valve*, as by Walker's patent "new system," or combination of valves, in connexion with purifiers? This inquiry is perfectly free from invidiousness.

Dec. 21, 1874. QUERIST.

VENTILATION OF BED-ROOMS.

SIR,—In the *Scientific Press*, a writer on the ventilation of bed-rooms says: "The deadly carbonic acid gas, which comes from the lungs of every out-breathing of the sleeper, rises to the ceiling in warm weather, but falls to the floor when the room is freezing cold; hence, in summer the purest and coolest air in a room is near the floor, in the winter the foulest air is near the floor." Professor Würtz, the editor of the *American Gaslight Journal*, demurs to this, and considers it incredible that in winter the carbonic acid gas from the expired breath falls to the floor.

The professors may disagree on this point, but we know that cold rooms are unhealthy in winter from more causes than one, and all would use fires if it were not for the expense. A small gas-stove in a sleeping-room will, at a trifling expense, keep the temperature a few degrees above freezing point, making the room comfortable and healthy.

Sydenham, Dec. 26, 1874. MAGNUS OHREN, A.I.C.E.

Legal Intelligence.

WORSHIP STREET POLICE COURT.—THURSDAY, DEC. 31, 1874.
(*Before Mr.* BUSHBY.)

STEALING GAS.

William Mills, a gas-fitter and general smith, carrying on business in Rushton Street, Hoxton, was summoned by the Independent Gas Company for improperly burning their gas, under the following circumstances:—

It appeared from the evidence that the defendant was a customer of the company, and paid the quarterly accounts sent in to him, and the company had no suspicion that anything was wrong until on the 20th of December an anonymous letter was received by the secretary. In consequence an inspector and two men were sent to examine the defendant's place. It was then found that the pipe which should have passed the gas into the meter had been disconnected, and a piece substituted, to pass under the meter, to let the gas into the service-pipes used for the house. It was so cleverly done that it could be disconnected at a moment, and the original pipe joined again to the meter. While off, of course the gas not passing through the meter was not registered, and the company were at a loss for the same. When the discovery was made, the inspector went to the office to report the fact, but left two men in charge of the meter. During the inspector's absence the defendant took an opportunity of replacing the service-pipe, but was seen by one of the men left in the place, and when taxed he said that he found it was wrong, and had altered it. Subsequently he called at the office of the company to offer an explanation, and then said that he did not know of it. One of his workmen had discovered a leak in the fittings, and he had been told to alter it, and must have substituted the piece of pipe found by the company's men.

This was the defence set up by Mr. PYKE on the part of the defendant, and he also put in the quarterly accounts, which, he said, showed the defendant's *bona fides*.

Mr. BUSHBY thought not, and had no doubt that the defendant perfectly well knew of the whole matter. Had he not known of it, the gas would always have passed under the meter, instead of through it, and never have been registered; so there would never have been any quarterly accounts. The fact of there being gas to register was a proof that gas was sometimes allowed to pass through the meter to avoid suspicion. He ordered the defendant to pay a fine of £5 and costs.

DIXON FUND.—We are requested by the hon. secretary to this fund (Mr. W. H. Bennett) to state that, he believes, it will be gratifying to the contributors to learn that the subscriptions amounted to £276 9*s.*, and that the committee (consisting of Messrs. J. Church, Stephenson Clarke, George Livesey, A. Penny, R. P. Spice, and C. Woodall) have just concluded their labours by purchasing for Mr. Dixon a Government annuity of £24, the difference having been expended in the relief of Mr. Dixon's more pressing necessities, while the list remained open, and the payment to him of a balance of £15 6*s.* 5*d.* The committee are anxious to express their thanks for the kind response the appeal met with, and are pleased to think that every subscriber will have the satisfaction of knowing that he had helped to smooth the declining years of a worthy member of the profession, whom misfortune had overtaken at a time of life when he was incapable of battling with adversity.

BEVERLEY (CORPORATION) GAS SUPPLY.—At the meeting of the Town Council of Beverley, on the 1st inst., the Gas Committee advised a reduction of the scale of discount to large consumers of one-half, the maximum allowance to be 10 per cent., instead of 20 per cent., as heretofore. Mr. Whiting moved that the whole question be referred back to the committee, and Mr. Hind also moved that the present rate of discount cease from that day. A long discussion ensued, in which Alderman Croskill maintained that at the present price of 4*s.* 2*d.* per 1000 feet the gas realized a fair profit, and expressed a strong opinion that if discount was refused to large consumers, there would soon be another gas company in the town, and moved the adoption of the report, which was eventually carried.

POLLUTION OF WELLS BY GAS AT GALASHIELS.—An unusual circumstance has occurred in the pollution of some of the Galashiels wells by an impregnation with coal gas in the district embracing the head of High Street and foot of Island Street. About two or three months ago, a well near the foot of Island Street was discovered to be impregnated with gas, and, as it got worse, it was by-and-by locked up. About a month ago a public well near the head of High Street, which supplied a large number of families, was discovered to be as bad as that in Island Street. So badly tainted was it that its use was immediately discontinued. The main supply gas-pipe is carried up the High Street about 20 yards from these wells, and it is supposed that a serious leakage exists somewhere. The whole soil is tainted with a strong smell of gas, and it is believed that it has even entered the water company's supply-pipes. Whether arising from this or from some other cause, typhoid fever of a somewhat malignant type has manifested itself in the district adjoining the polluted wells, and two cases have had a fatal issue. Nothing has as yet been done to remedy the evil.—*Scotsman.*

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the composition and quality of the metropolitan waters in December, 1874:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	18·87	0·135	0·104	0·002	14·1	4·1
West Middlesex	18·31	0·049	0·147	0·000	13·8	3·6
Southwark and Vauxhall	18·53	0·104	0·127	0·002	14·0	4·0
Chelsea	18·57	0·125	0·124	0·002	14·0	4·2
Lambeth	18·67	0·095	0·125	0·002	14·0	4·0
Other Companies.						
Kent	27·17	0·001	0·247	0·000	21·0	6·0
New River	19·67	0·016	0·161	0·000	14·4	4·0
East London	20·20	0·029	0·180	0·000	15·0	4·0

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was more or less turbid—namely, in those of the Grand Junction, Southwark and Vauxhall, the Chelsea, and the Lambeth Companies. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Society of Medical Officers of Health, 116,336,586 gallons; and the number of houses supplied was 513,520. This is at the rate of 34·2 gallons per head of the population daily. The last official return from Paris stated that the average daily supply per head of the population was 27·3 gallons; but this includes the water used for the public fountains, and for the ornamental waters in the Bois de Vincennes and the Bois de Boulogne.

Hy. Letheby, M.B.

Dr. Frankland's report, as the result of a chemical analysis of the water supplied to the metropolis during December, is as follows:—"The Thames was in flood at the beginning of the month, and the water companies drawing their supplies from that river had the usual difficulties to contend with in their efforts to secure efficient filtration. On the 3rd inst. the Chelsea Company delivered very foul water, but the other companies supplied a clear and transparent beverage. On the 11th inst., when I again drew samples, the Chelsea Company's water had scarcely improved; it was still very muddy. The mains of the Grand Junction Company were also charged with turbid water, and the sample drawn from the Lambeth Company's service was slightly turbid. The remaining companies, however, continued to deliver clear and brilliant water. Living and moving organisms were found in the water of the Grand Junction and Lambeth Companies. Besides abundance of such organisms, the Chelsea Company's water contained fragments of woollen and cotton fabrics, clots of the mycelium of a fungus, and fibres of partially digested or decomposed flesh meat. The water thus charged with fœcal and other refuse matters was unfit for dietetic purposes, and could not be so used without serious risk to health. On the other hand, the water drawn from the Lea by the New River Company was of very good quality, and was clear and transparent. The East London Company also delivered clear and bright water of a quality much superior to that distributed by even the best regulated companies drawing from the Thames. The Kent Company's water from deep wells in the chalk was bright, palatable, and wholesome."

The Registrar-General publishes the following table of the average daily quantity of water supplied by the London water companies, during the month o November, 1874. According to their returns 111,277,035 gallons, or 505,583 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight) were supplied daily; or 216·6 gallons (98·4 decalitres), rather less than a *ton* by weight, to each house, and 30·5 gallons (13·9 decalitres) to each person. According to returns of the London water companies made to the select committee on East London Water Bills (session 1867), it is estimated that, during the year 1866, about 82 per cent. of the total average daily supply of water for all purposes was for domestic use. Applying this proportion to the total quantity supplied daily in the month of November, 1874, it may be estimated that about 91,247,169 gallons were probably used for domestic purposes, or about 25 gallons per day for each inhabitant, against 25·3 in the corresponding month of last year. This proportion no doubt varies from month to month, but the Registrar-General has no means of giving a more exact estimate.

Companies.	Number of Houses, &c., supplied in		Aver. Daily Supply of Water in Gallons* during	
	Nov., 1873.	Nov., 1874.	Nov., 1873.	Nov., 1874.
Total supply	506,792	513,772	110,814,481	111,277,035
From Thames	238,056	241,404	58,864,363	57,439,311
,, Lea and other Sources	268,736	272,368	51,950,118	53,837,724
Thames.				
Chelsea	28,395	28,490	7,907,400	7,514,000
West Middlesex	45,217	46,363	8,941,474	9,063,251
Southwark and Vauxhall	79,512	79,832	19,006,250	18,000,500
Grand Junction	34,718	35,144	11,488,539	10,239,160
Lambeth	50,214	51,575	11,520,700	12,617,400
Lea and other Sources.				
New River	121,809	122,748	24,536,000	26,086,000
East London	104,481	106,459	21,177,598	21,614,500
Kent	42,446	43,161	6,236,520	6,137,224

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for November, 1874, as compared with that for the corresponding month of 1873, shows an increase of 6980 houses, and of 462,554 gallons of water supplied daily.

Chelsea Water Company.—At the meeting of the Chelsea Vestry, on Tuesday last, Dr. Barclay, the medical officer of health, made the following report:—"The result of the analysis of water obtained from the service of the Chelsea Water Company on the 11th and 12th of this month (Dec.) is eminently unsatisfactory. About two months since I had an analysis made of the water supplied by the same company, but drawn from an underground tank, while, in the present instance, the water was received from the service-pipe before it reached the cistern. Although the tank was found free from contamination, the comparison ought to be in favour of the last sample. On the contrary, however, it was found that there was a very considerable excess of free and albumenoid ammonia, which together indicate decomposing animal matter in the water, while the accompanying increase in chlorine lends great strength to the suspicion that these impurities are mostly, if not entirely, due to sewage contamination. The water, when drawn, presented a turbid appearance, which slowly subsided, leaving the water, after standing for some time, quite bright and transparent. It is impossible to say how much of this turbidity was due to chalk stain and how much to organic matter. The report by Dr. Frankland to the Registrar-General of the water obtained by him from the Chelsea Company's main, on Nov. 5, as compared with that obtained on Sept. 16, points in the same direction, but we have not yet had his report for December. The results obtained in our own laboratory point out two great defects in the water supply given by the Chelsea Company—1, that they do not possess sufficient storeage room to allow such turbidity to subside as cannot be removed by filtration; 2, that their intake is liable to exceptional pollution after heavy rainfalls from the influx into the Thames of water from the Mole or some other tributaries near the point from which their supply is drawn." A copy of the report was directed to be sent to the company. The resolutions adopted at the special general meeting of the company, on the 18th ult., were as follows:—"That the directors be authorized to take such steps as, in their judgment, may be necessary or expedient to obtain a fresh intake, with reservoirs and other works connected therewith, and lay the necessary main-pipes from the site of such proposed intake to the works at Seething Wells, with the least possible delay. That the measures taken by the directors to secure the land necessary for the construction of impounding reservoirs be approved and adopted, and that they be empowered to appropriate temporarily such part of the company's 'contingency-fund' as may be necessary for the purpose of such land, until parliamentary powers can be obtained for the proposed extensions. That the directors be authorized to apply to Parliament in the ensuing session for the necessary powers. The land, comprising an area of about 30 acres, necessary for the construction of the impounding reservoirs, has been obtained near Molesey."

NEWCASTLE AND GATESHEAD WATER SUPPLY.

An Adjourned Meeting of representatives from various authorities interested in obtaining a supply of pure and wholesome water for the district was held in the Town-Hall of Gateshead, on the 19th ult. The Mayor of Gateshead (G. Charlton, Esq.) occupied the chair.

The Clerk (Mr. Swinburne) read replies, from the local boards, to the circular issued in accordance with the resolution passed at the previous meeting, asking whether or not they would be willing to form part of a joint water authority for the district. The Tynemouth Town Council had negatived a motion to offer to share in the expenses incurred by the Gateshead Conference in ascertaining the best and cheapest mode of obtaining an efficient supply of pure and wholesome water for the district, and the rural sanitary authority of the Tynemouth Union declined to form part in a united water authority. The Chester-le-Street Board had sent a deputation to this meeting to obtain further information. The Haltwhistle Rural Sanitary Authority, Cramlington Local Board, and the Cowpen Quay Local Board declined to form part of a united water authority; the Willington Quay Local Board were willing, if a majority joined in the requisition, to get the Local Government Board to send down an inspector; and the Wallsend Local Board stated that they were not at present sufficiently informed to enable them to decide, but were favourably disposed to any well-considered scheme. The Durham Sanitary Authority had come to no decision, but it was stated that the Weardale and Shildon Water-Works Company had compulsory powers over a large part of the rural sanitary district of the Durham Union. The Blyth Local Board replied that all the inhabitants within the jurisdiction of the Blyth Local Board have had for the last 20 years a plentiful supply of pure wholesome water from the private water-works belonging to Sir Matthew White Ridley, Bart.; this being the case, the board did not consider it desirable for them to tax the rated inhabitants with the expense of forming a united water authority. No communication was made to the meeting from the Newcastle authorities, but Mr. Cook, a member of the council of that town, who was present, said the position of Newcastle at the present time was similar to that of Gateshead. They had both applied for an inspector, and when that Government inspector came he would take evidence upon the whole subject, and from that time Newcastle and Gateshead would be one—the one acting jointly with the other.

Alderman Newall remarked that there was a proposition from Liverpool and Manchester to join and get 80 million gallons a day from Ullswater, at a cost of from two to four millions of money. They would, therefore, have strong opposition, and there was no doubt they ought to be early in the field, and have all their plans prepared, so as to go as strongly as possible to Parliament. It was Mr. Bateman who recommended that scheme from Liverpool and Manchester. Mr. Hawksley was in favour of another scheme.

Mr. Bewick, C.E., then proceeded to explain his Northumberland Lake scheme. He said he had recently been asked questions about the depths of the Northumberland Lakes, but he desired it to be understood that he did not contemplate taking any part of the water out of the Northumberland Lakes at their present level. It was simply the storeage water above the present level of the lakes that he proposed to utilize. Therefore, so far as the depths of the lakes were concerned, the question was not affected. Taking Greenlee Lough, which was the most important, when raised 30 feet it would give an area of 464 acres and an estimated capacity for 3000 millions of gallons. Greenlee was the principal lake, and the one which he considered ought to be utilized. The other was Broomlee, which, raised 25 feet, would give an area of 186 acres and a capacity for 1000 millions of gallons. Crag Lough, raised 20 feet, would possess 68 acres and a capacity for 350 millions of gallons—giving a total of 1718 acres and 4350 millions of gallons altogether. With regard to the rainfall, he had gone carefully into the statistics published by Mr. Symons for the last five years, and found that there had been an average annual fall in the North of England during that period of 43·6 inches. But the basis of his calculations was the smallest fall in any one of the five years—viz., 1870—when the average fall in this district was 33 inches, and, after making allowances for absorption, consumption by millowners and by evaporation, &c., he reduced the available fall to 9 inches. And this on a gathering-ground of 60 square miles, the actual area, gave 7841 millions of gallons per annum, or over 21 million gallons per day—a quantity far in excess of the requirements of the population of Tynedale. Properly utilized, at the rate of 15 million gallons per day, such a quantity would be sufficient for 450,000 people, taking 30 gallons per day. Allowing for the increase of population in Newcastle and Gateshead and district since 1871, there were probably not less than 300,000 people requiring water; and in 1901, 27 years hence, probably there might be half a million. For these numbers it was necessary to provide, or at any rate to be prepared for the increase. Taking the consumption at 30 gallons per day, the present requirements would amount to 9 million gallons per day; and upon the commencement of the next century they might calculate on a consumption of 15 millions gallons daily—a quantity which the gathering-grounds he had described to them were capable of supplying. With reference to the ground itself, it was absolutely free of manufactories, and there were only one or two coal mines upon it—collieries really so small as scarcely to call for notice. No doubt a very large portion of the area was covered with peat; he could not exactly state what proportion, but it was like all high districts of that class—there was more or less peat.

Alderman Newall said the matter resolved itself into a very small question—namely, which water was the best of the Northumberland Lakes, East Northumberland or Ullswater schemes. He maintained that peat water was the most unwholesome that could be brought into a town, and he believed nothing else would come from the Northumberland Lakes. He was sorry to say it, but he believed a great portion of the ground was covered with peat. As regarded the quantities to be supplied, that was a matter which could easily be settled.

After some further observations, Mr. COOK, on the suggestion of the MAYOR, moved as follows:—"That this meeting respectfully requests the corporation of Newcastle and the local authorities of Wallsend, Willington, Felling, and other local authorities willing to take part, to appoint committees to act in union with the Water Committee already appointed by the Gateshead Corporation, and to report to future meetings."

Mr. GRAHAM seconded the motion, which was carried unanimously.

BIRMINGHAM (CORPORATION) GAS BILL.

THE ATTITUDE OF THE OUT-DISTRICTS.

WEDNESBURY.

At the Meeting of the Local Board of this Town on the 28th ult.—the CHAIRMAN (Mr. R. Williams) gave an account of the interview of a deputation, consisting of himself, Mr. Lloyd, and Mr. Mason, with the Mayor of Birmingham, in reference to the scheme of the corporation for the purchase of the gas-works. Having borne testimony to the extreme courtesy of the mayor, who had shown the utmost willingness to furnish all the information sought for, he said the question for the consideration of this board was whether it was necessary or desirable they should act hostilely in the matter. If they could get all they wanted without having a legal representative before the committee of the House of Commons—and from what they gathered from the mayor he thought they could—it was very desirable they should do so. Wednesbury, it appeared, was very slightly interested in the matter as compared with Birmingham, the total annual consumption of the former being about 50 million feet of gas as against 2000 million in the latter. The ratio was, therefore, about forty as one, and consequently whatever might be done in the way of forcing up prices in Wednesbury would not affect the price in Birmingham. Walsall also consumed about the same quantity as Wednesbury. These two places, with Darlaston, were differently situated from the other places affected by the scheme, and could, if it were wished, be easily severed from the gas company's arrangements, and have works of their own. They were the limbs, as it were, and could be lopped off without affecting other parts, such as West Bromwich, which was the heart of the system, the works being there. They asked the mayor what he was prepared to do, and he replied precisely what the present gas companies did. The maximum price of those companies was 4s. per 1000, but they had not gone above 3s. 6d., and the outlying places would be charged precisely the same as Birmingham; and if Birmingham, with a consumption of 2000 million cubic feet, would not consent to be raised to the maximum, they might depend upon it that the outlying districts would not be raised. They had, therefore, these two material guarantees that they would not be worse off under the corporation than under the companies. The next question was how were the profits to be divided; and the mayor was of opinion that, as at present in the case of the companies, a reserve-fund might be allowed to accumulate, and be used in times of adversity, but it remained to be seen whether the corporation would have power to adopt such a plan. They impressed upon the mayor the necessity of the profits being equally divided between Birmingham and the outlying districts; and were informed that an arrangement might be made whereby such a distribution might be effected. This point was not as clearly settled as the deputation would have liked, but there it was, to be dealt with, and it brought them again to the self-acting check of the large number of consumers in Birmingham keeping down the prices. As to the outlying districts not knowing what the Birmingham Corporation was doing with regard to the works, the mayor said he would suggest that those districts should have representatives on the Committee of Management. This he (the speaker) thought was a very fair way of dealing with the matter, and if the promoters of the scheme would do all this, it was as much as the board could expect if they were to go to the House of Commons. The mayor also said he was prepared to sell the plant of the outlying districts if he were pressed, but he would rather not do so, because his calculations were all based upon the concern as a whole. Then came the question of price, which was the touchstone of the whole thing; and it was for them to consider whether they should decide upon buying at once, and fix the price, or whether they should leave it to the operation of time and see how the scheme worked. If they could prove a charge of extortion against the companies they might get power to establish works of their own, but not otherwise; and, therefore, he for one was disposed to go on as they were, working with the Birmingham Corporation in carrying out the scheme; and see whether it dealt unjustly by them. If the mayor assured them that there was a provision to sell to them if they desired it, and that the price of gas supplied to them should not be greater than the price in Birmingham, what more did they want? At any time hereafter they could purchase if they found they were being unjustly dealt with.

The CLERK remarked that it was very doubtful whether at present they had power to purchase.

Mr. W. LLOYD said it might be desirable that they should have power to make gas for themselves, but if Birmingham would supply them at a moderate rate, there was no reason why they should exercise it. As an ordinary precaution, however, he advised that they should be represented before the committee, to ensure the insertion of clauses in the bill providing for an equal division of the profits between the consumers and the ratepayers, and for the board having power to buy the mains in their streets. If they could get all that the mayor had promised and the chairman had detailed, all would be well, but he should like something more tangible than a mere interview.

The CLERK then read a report of the interview, which he had sent to the mayor for his approval before publication, and which ended with a recommendation from the deputation that the board should proceed to obtain powers, under the Municipal Corporations (Borough Funds) Act, to expend money in the purchase of the mains.

The CHAIRMAN said the mayor expressed an opinion that the corporation, in years to come, would perhaps be anxious to sell the outlying parts of the plant when the requirements of Birmingham became greater. This, he considered, was another reason in favour of "a waiting game."

A discussion arose between Mr. LLOYD and the CHAIRMAN as to the profits to be expected from independent works, the former being of opinion that the town might save £3000 a year by such an undertaking, and the latter that no profit at all would remain, taking into account that a capital of £50,000 would be required, while a profit of not more than 1s. per 1000 feet could be expected, which would only pay the interest upon the capital employed.

Mr. HITCHIN advocated waiting before purchasing, and expressed an opinion that the people of Birmingham, who would have to find the money for the purchase, could not be expected to consent to the people of the district participating in the profits.

The further consideration of this question was adjourned.

HANDSWORTH.

At the Meeting of the Local Board of this district on the 30th ult., the consideration of the purchase bill of the Birmingham Corporation came on specially for discussion.

The CHAIRMAN (Mr. Aston) expressed a hope that if they decided to oppose the bill it would not be considered factious opposition. He thought that it was the duty of the board to take proper steps to secure a *locus standi*, so that they might claim that they should be served with gas at the same prices as the Corporation of Birmingham would supply the borough. At the same time, if Handsworth, Smethwick, West Bromwich, and the outlying districts could come to an arrangement with the corporation to have proper clauses inserted in the bill to the satisfaction of all the districts, it would be better than going to Parliament to oppose the corporation.

Mr. ELLIS said it was their duty to petition the House of Commons in order that they might oppose any clause detrimental to the interests of the parish. There was a clause in the bill at present which fixed the maximum charge for gas, but he believed it was proposed to do away with it, and therefore the corporation would be at liberty, under those circumstances, to charge as high as 7s. 6d. per 1000 feet of gas.

The CHAIRMAN proposed a formal resolution to the effect that it was expedient, for the promotion and protection of the interests of the inhabitants of the district, to oppose the various bills now being promoted and intended to be brought into Parliament in the ensuing session of Parliament, and that the public funds or rates under the control of the board should be used to defray the cost of the opposition.

Mr. ELLIS seconded the motion, and it was supported by Mr. JOESBURY, who said that if the expenses of opposing the bill amounted to £100, the district would not consider that out of the way if they thereby saved several thousands of pounds.

After further discussion, the motion was passed.

The CLERK explained that it would be necessary to call a public meeting to receive the ratepayers sanction, and it was understood that the chairman would call one upon a requisition being presented to him.

TIPTON.

The Local Board met on the 29th ult.—Mr. UNDERHILL in the chair.

Mr. SANDERS, the solicitor to the board, brought under notice the Purchase Bill of the Birmingham Corporation, and remarked that if the Birmingham people wished to buy the gas companies works for the sake of a profit, it would be well for Tipton to purchase that portion of the undertaking within their own parish. The board should endeavour to have inserted in the bill a clause whereby Tipton might be able at a future time to purchase their portion. That would work nicely for Tipton, which, with coal so close, and coke easily disposed of, could make gas much cheaper than Birmingham, where they had to purchase and draw coal from a distance. There would be no division of profits from Birmingham, for the corporation bill contained a clause stating that all the net profits were to be passed on to the borough fund at Birmingham. The chairman at Wednesbury had slipped into a mistake when he said that the best plan would be to go on with Birmingham, but purchase if they found themselves badly treated. He (Mr. Sanders) did not believe that Wednesbury or Tipton could purchase unless they had secured clauses to that effect in the bill sought for by the Birmingham people. He did not think the board could successfully oppose the Corporation of Birmingham as to the purchase, for, in 1845, an Act was passed giving the power. All they could do was to endeavour to get a clause enabling them to buy the part of the undertaking in Tipton. They were not likely to get any share of the profits, because they were finding no share of the capital. Still, they could oppose the bill in a friendly way, and he had drawn up the following resolution:—"That this board, for the promotion and protection of the interests of the inhabitants of the district of the board, do oppose the various gas bills now being promoted, and intended to be brought into Parliament in the ensuing session by the Corporation of Birmingham, the Birmingham Gaslight and Coke Company, and the Birmingham and Staffordshire Gas Company, and also the bill of the South Staffordshire Water-Works Company; and that this board do apply the public funds or rates under the control of the board in payment of the costs and expenses of such opposition."

The CHAIRMAN was not in favour of a factious opposition to Birmingham, and believed that Tipton people would never be charged more than the Birmingham people.

Mr. GEORGE said it would be well if they failed to obtain the clauses spoken of by Mr. Sanders, to obtain the fixing of a maximum price.

Mr. COX moved, and Mr. GEORGE seconded, the adoption of the resolution, and it was carried unanimously.

A committee was then appointed to watch the several bills.

HULL GAS SUPPLY.

On Thursday last a Special Meeting of the Members of the Hull Guardian Society was held to consider the question of the supply of gas to the town. The PRESIDENT (Alderman Seaton) occupied the chair, and briefly introduced the business of the evening.

Mr. ELAM was the first speaker. He said it was scarcely in his province, as a member of the corporation, and as the intended mover of a resolution in that body, to move a resolution at this meeting on the subject, but rather to leave the question to the meeting for debate. He would remark, however, that the quality and price of gas in the east district and the old town were greatly complained of. Within the docks there were tradesmen paying £180 a year for gas, or at the rate of 4s. 6d. per 1000 feet; whereas, if the present monopoly was done away with, gas might be supplied at the rate of 2s. 6d. per 1000. This was very unfair, and a remedy was needed. He intended bringing the matter before the corporation, as the body to whom the ratepayers had a right to look for a remedy for the present grievance. The gas company had been appealed to in vain, and the corporation must remedy the existing state of affairs. He did not believe it was right or reasonable that they should buy the gas-works at the present artificial price. Many persons in the west district might consider they were not interested in this question; but he maintained they were, and that figures which he would give as to the lighting of the streets would show it.

Mr. LEAK (the secretary) observed that he had referred to the Act of the company in the old town, and found they had no monopoly granted them in precise terms. The company had power to supply gas in the old town, Myton, and Sculcoates. The only way in which they had a monopoly was practically in this way—that no other company had powers to break up the streets for the purpose of laying down their mains. It might be said, and possibly some gentlemen might think so, that the local board had power, but that did not appear to be so.

Mr. SCOTT questioned, therefore, whether Mr. Elam's intended motion would be of avail.

Mr. ELAM said these questions would come after a committee was appointed. He believed if an arrangement was made with the old company the Sculcoates Company would be ready to supply gas to this district at their present reasonable price. He believed an Act of Parliament or Provisional Order would probably be necessary.

The VICE-PRESIDENT considered they ought to support Mr. Elam in his efforts, and he moved—"That the members of the Hull Guardian Society, consisting of about 700 bankers, merchants, and traders of the borough of Hull and the neighbourhood, assembled in general meeting, specially convened to consider the supply of gas to the inhabitants, and the price charged for the same, hereby resolve—'That the quality of gas supplied being inferior and the prices charged by the several companies supplying the borough with gas being unequal in amount, and also exceptionally high, both to the lighting authorities and the general public, for such a large borough as Hull, are unjust and very prejudicial to the trading and general interest of the port; that it is desirable that steps should be immediately taken to remedy the evils complained of; and, therefore, cordially approves of the resolution proposed to be moved by Mr. Elam, in the Board of Health, for a special committee to report upon the supply of gas to the borough.'" He considered no consumer of gas should hesitate in taking steps to remedy the present cause of complaint. He not only com-

plained of unequal price, but of the quality; and a friend of his was glad to get away from where the gas was used, to his benzoline lamp, so as to prevent injury to his eyes.

Mr. T. JACKSON seconded the motion, as a large consumer of gas; the difference in price between 4s. 6d. and 2s. 6d. being very great, and an important consideration to large consumers. As to the quality of the gas, he was afraid the old gas company, in its present small premises, could not give them pure gas.

Mr. BAYNES agreed that a cramped-up gas-works operated against a supply of pure gas, free from ammonia, which was complained of in drapers and other shops.

Mr. ELAM here mentioned that the ratepayers were paying over £600 more for the lighting of the east district of the old town, than they would have to pay if the Soulcoates Company were lighting the whole town. This saving to the ratepayers represented £15,000 capitalized at 4 per cent.

Mr. BLACKBOURN said that in 1833, at an inquiry into the management by the old corporation, this question of the gas supply and charge cropped up, and it was stated consumers paid one-half more in the old town than in Soulcoates. A remedy was then talked about, the obtaining of a supply from without the docks, and a pipe was laid under the dock basin. Perhaps the then suggested remedy would be preferable to the motion before the meeting.

The PRESIDENT said if Mr. Blackbourn had been at the meeting earlier, he would have heard an opinion from Mr. Leak which showed that what he suggested could not be carried out under the existing law.

Mr. BAYNES mentioned that the late Mr. Thompson, when town-clerk, advised prudently and rightly that the corporation had no right to give any sanction for the breaking up of streets. It was after the year alluded to by Mr. Blackbourn.

Mr. LEAK repeated his opinion that courts of law had decided that no person was allowed to break up the streets except by parliamentary powers. The powers of a local board, in respect of lighting, were so far as enabled them to prepare for the lighting of a street, and contracting with persons for the lighting.

Mr. BLACKBOURN said it appeared that corporations had power in other days.

Mr. LEAK: They thought so.

Mr. BAYNES: They presumed to have.

The motion was then agreed to.

On the motion of Mr. CHEESEMAN, seconded by Mr. PEARCE, it was resolved—"That a copy of the resolution be sent to the mayor, with a respectful request that it be read prior to the discussion in the Board of Health on Mr. Elam's motion."

The meeting closed with a vote of thanks to the president for occupying the chair.

FOULIS'S HYDRAULIC STOKER.

On the 21st of April last we gave illustrations and full descriptive details of the hydraulic apparatus invented by Mr. Foulis, of the Glasgow Corporation Gas-Works, for drawing and charging retorts, and to-day we have much pleasure in stating that machinery of this description is now being erected in Manchester, by Messrs. Woodward and Sons, of that city; in fact, it is already partially in operation. The following extracts of reports by the makers, dated the 23rd ult., have been sent to us for perusal:—"In reply to yours of the 22nd inst., we are glad to inform you that yesterday we started the raking machines at the Manchester gas-works, and they are working exceedingly well. A number of the committee were present, and were pleased with the working of the machines. We expect to have the charging machines at work in the first or second week of the new year." In a letter dated the 31st ult., they say, "We expect charging machines will be at work in a few days. . . . The rakes are a splendid job, and work first rate. They are working regularly night and day. We are sparing no pains to make the charging machines as successful." Mr. Foulis, in conjunction with Messrs. Woodward and Sons (the makers for the Manchester district), and Messrs. Tangye Brothers and Holman (who are the appointed agents for London and other parts of England), has made such modifications as to render these machines remarkably simple and effective. The principal feature of improvement has been the substitution of adjustable single rakes and scoops, in lieu of fixed levels or lines of traverse. By this arrangement the same rake and scoop are readily raised and lowered to charge and discharge every retort in every bench throughout the house. The machinery which last April we stated had been erected at the Dawsholm station of the Glasgow Corporation is still at work satisfactorily.

THE "SOCIETE DES USINES A GAZ REUNIES."

The proceedings instituted in the Paris Chamber of Correctional Police, against M. Emile Gautier, and the directors and other persons concerned in the formation and management of the above society, were brought to a close on the 3rd of December last, when the court passed sentence. The persons implicated were altogether 11 in number, including the Marquis de Messey, chairman of the board; M. Berthelet-Viel and the three other directors; and M. Crozet, director of the "Comptoir National des Fonds Publics," and they appeared before the court on a charge of fraud and violating the law of public companies. The case has been already referred to in previous numbers of the JOURNAL; but the facts may be here briefly recapitulated as follows:—

In the year 1860, M. Emile Gautier, a Belgian by birth, in conjunction with M. Lenoir, a chemist, and several other persons, formed a society for developing a motive power consisting in the expansion of air and the combustion of gas by means of electricity. In 1863 the society was converted into a company, with a capital of 1 million francs, in 2000 shares of 500 francs, and this company remained in existence till 1868, when it went into liquidation with a deficit of 481,000 francs. It was then reconstituted under the title of the "Société des Moteurs Lenoir et des Usines à Gaz Réunies," and devoted itself principally to the acquisition of concessions, the erection and purchase of gas-works, and generally to matters connected with gas industry. In the meantime 16,000 debentures were created, and placed, with the sanction of the board of directors, at Gautier's disposal, to be issued when he thought proper. By misrepresenting the value of these debentures, he not only induced the public to subscribe for them, but by giving flattering accounts of the society's progress, obtained authority from a general meeting to issue 32,000 debentures and 12,000 additional shares. These latter, however, were not readily taken up. He thereupon established an office, under the name of the "Comptoir National des Fonds Publics," for the purpose of floating them; and about the same time started a financial paper, the *Probité Financière*, which was to be the medium for keeping them before the public. In 1871, by presenting a fictitious list of shareholders, who were represented as having paid up a quarter of their subscriptions, he induced the Bourse to quote a certain number of shares and debentures; and by puffing the society in various papers, at a very large expenditure, he managed to issue a portion of these new shares. Sufficient capital not being raised in this way, he was compelled to borrow money at ruinous interest. The debentures, however, fell on the Bourse; and early in 1874 the company was refused a contract to supply Bordeaux with gas, on the ground of the instability of its position. It was discovered, moreover, that Gautier had wilfully mixed up the numbers of the bonds recognized by the Bourse with those which had not been allowed a quotation. On his arrest it was found that he had created 84,600 bonds, 50,000 of which, issued at an average rate of 165 francs, had been actually taken up by the public, producing, with certain other sums, a total of 9 million francs, for which Gautier was accountable. The liabilities of the society amounted to 11,393,292 francs, and the assets, including the sums not paid up on the shares, to 7,956,744, showing a deficit of about 3,437,000 francs. The shareholders will receive nothing, and the debenture-holders and other creditors will barely obtain 65 per cent. The result of the society's operations altogether shows a deficit of 5,128,947 francs.

In passing sentence, the court found that Gautier had had the management of the society since 1863, and that, finding its affairs in an embarrassed condition, he had called a meeting, and reconstituted it under the title of the "Société des Usines à Gaz." He had also spread abroad fictitious reports as to the existence of works which were to serve as security to the bondholders. By means of illusory promises freely held out, he had succeeded in obtaining subscribers to the first and second issues of bonds; but the Bourse, considering the capital of the society to be insufficient, had refused to admit them to official quotation. Gautier had represented himself as the manager of a society possessing resources which in reality did not exist, and had thus deluded the public into investing money in what he knew to be an unstable concern. Considerable publicity had been given, through the medium of the press, to all the issues of bonds that had taken place between 1871 and the commencement of 1874, and the society's prosperity was set forth in the glowing reports presented by the manager at the general meetings—reports which had received the approval of the board of directors—and further attested, to all appearance, by the concocted balance-sheets which from time to time appeared. Gautier had also been guilty of fraudulent transactions in endeavouring to obtain for the society's bonds an official quotation on the Bourse, inasmuch as he had knowingly presented a fictitious list of subscribers. With regard to the establishment of the office for the issue of the bonds, and the starting of the *Probité Financière* for puffing them, the court was of opinion that in both cases the necessary funds were furnished by Gautier, and that no less a sum than 170,000fr. had been employed for the purpose. In the matter of the falsification of the lists of shareholders, it had been proved that the list deposited with the notary in September, 1874, with the declaration that it contained the names of those shareholders only who had paid up a fourth of the amount of their shares, was altogether fictitious, as many of the names appearing in it had been inscribed without the consent of the parties. This fraudulent act had been repeated by the deposit with the syndicate of the Bourse of a second list equally fictitious, and the court was of opinion that, in this respect, as in the publication of untruthful reports and balance-sheets, Gautier's intention evidently was to deceive the public; and, even if he had failed in so doing, the attempt in itself was punishable as a criminal act. With reference to the charge of declaring fictitious dividends, the court was of opinion that the persons present at the general meetings held in 1873 and 1874, at which dividends of 45fr. and 50fr. were declared for the preceding years, had been deceived by the falsified accounts then presented by Gautier, the fact being that at that time the society was not in a condition to meet its expenses. The last charge preferred against Gautier was, that he had been guilty of creating majorities at the general meetings; but on this point the evidence was considered insufficient to justify a conviction.

With regard to De Messey, the court acquitted him of all complicity in the negotiation of shares and the declaration of fictitious dividends, considering that Gautier was alone culpable in this respect. But as far as concerned the steps taken by Gautier to secure subscribers to the bonds issued in 1871 and following years, the court was of opinion that, intimately connected as De Messey was with the manager, by virtue of his position, he could not possibly have been ignorant of his proceedings, and that he must also have been aware of the means employed for securing the quotation of the shares on the Bourse, inasmuch as he had agreed, on Gautier's proposition, not only to have his own name on the list presented to the syndicate, but had requested two of his friends to do likewise. Nor could he have been ignorant of the establishment of the "Comptoir National," or of its object, seeing that he had agreed to become one of the directors of that society; he was also equally well aware of the objects for which the *Probité Financière* was started. Besides this he had never hesitated to attach his signature to the bonds issued by the society, and had thus given a factitious value to documents which he knew to be worthless. The opinion of the court, therefore, was, that in these respects he must be regarded as having acted entirely in concert with Gautier, and consequently was equally guilty.

In the case of Berthelet-Viel, one of the directors, the court was of opinion that as a holder of shares in the "Société des Moteurs Lenoir" since 1864, he could not have been ignorant of the fact that in 1868 the capital of 2,000,000 fr. was more than exhausted, and that however small his experience in such matters might have been, he must have known that a company without capital, existing only by borrowing in every direction, was certainly not in a position to realize benefits for investors. He must also be considered to have participated in the proceedings in connexion with the official quotation of the shares, and in this respect as in several others to have aided and abetted Gautier in his fraudulent transactions, and therefore to have rendered himself equally amenable to the charge of infringing the law of public companies.

The sentence of the court, therefore, was that Gautier should be committed to prison for four years, with a fine 3000 fr.; De Messey, two years and 1000 fr.; Berthelet-Viel, one year and 500 fr.; Crozet, ten months and 500 fr. Gautier, Berthelet-Viel, and Crozet were also severally condemned in costs. The other defendants were acquitted.

EXPLOSION OF GAS IN KENTUCKY.—By an explosion at the gas-works at Mount Sterling, Ky., on the 18th of November last, two white men and one negro were instantly killed. The bodies were so burned as to be hardly recognizable. One or two other *employés* escaped. Two buildings, connected with the works were destroyed. The loss is not stated.

FRIENDLY SETTLEMENT OF THE GAS QUESTION AT CARNOUSTIE.—On the 22nd ult., a public meeting of the gas consumers was held in the Panmure Hall to receive the report of a committee appointed at the last meeting to wait on the gas directors in reference to the complaints as to the quality of the gas and the supply to the public street-lamps. The report stated that the committee had obtained a conference with the directors of the gas company, at which the grievances of the consumers were fully explained to the directors, and explanations obtained as to the reason of the bad gas, the quality of which, it was stated, had been greatly improved. With regard to price, the company had stated that they would reduce the charge as soon as they possibly could. On the subject of public lamps, the company expressed themselves favourable to an increase of lamps, and agreed, in the event of the community providing and putting up the lamps, that they would keep up and light them gratis; that such of the lamps as might be considered wrongly situated would be removed and placed in a more advantageous position at the company's expense, and that the lamps would be lighted on the nights the moon may be obscured. Also, that in accordance with a suggestion made at the conference, the gas company had appointed a committee to co-operate with a committee of consumers in regard to the proper lighting of the streets. The meeting unanimously approved of the report, and awarded a vote of thanks to the committee for their services. A committee, consisting of the previous committee with an addition of four gentlemen, was then appointed to consider and report from time to time in regard to the gas supplied to consumers, and also to meet with the committee of the gas directors in reference to the lighting of the streets. The proceedings closed with a vote of thanks to the chairman.

LEEDS (CORPORATION) GAS SUPPLY.

A Meeting of the Leeds Town Council was held on the 1st inst.—the MAYOR (Alderman Marsden) in the chair.

Mr. SCARR brought forward a motion respecting the management of the gas-works. He complained that the visiting sub-committee had not exercised sufficiently close supervision over the management of the gas-works. In order to stave off the question when he raised it, they proposed to meet once a fortnight and make him a member, but he declined, thinking they had not quite done their duty in the past, else the corporation would not have lost 6d. on every 1000 feet of gas sold to the public in 1874, and the price of gas would not have reached the present maximum of 3s. 9d. He mentioned that a private company in the neighbourhood of Wolverhampton were able to sell gas at 2s. 9d. per 1000 cubic feet, that at York the price was only 3s., and that at Burnley—saving only during six exceptional months—the price was 3s. He suggested that the Gas Committee should be divided into four sub-committees—one each to manage respectively the three gas-works, and a Finance Committee to manage at the gas offices. In this way he thought the works would be more efficiently managed. He submitted a resolution to that effect.

Alderman MASON seconded the motion, remarking that the gas in Leeds was not only more expensive than it should be, but very inferior in quality—a point upon which there were many complaints throughout the borough.

Mr. BROWN moved as an amendment that the matter be referred back to the Gas Committee for consideration and report. He said the gas in Leeds was made of a good illuminating power, but often it appeared of inferior quality on account of the old pipes through which it was conducted, and through defects connected with the houses supplied.

Mr. LUCAS thought that if the committee were split up into four parts they would clash with one another, and confusion would be caused.

Mr. JACKSON did not think that the system of dividing the committee would work satisfactorily. Referring to leakage, he said he believed the leakage in 1874 was 19 per cent., which, according to his calculation, amounted to 200 million feet of gas in one year, which, at a cost of 4s. per 1000 feet, was something like £40,000 a year. This was a serious item, and one which required to be investigated.

Mr. WRAY said he entered upon the duties of chairman of the committee two years ago, and he had not been in office two months before coal was 105 per cent. dearer. He had called the committee together, and many a time he had only had Mr. Brown to go round with him to the works. He would be glad to call the committee together at any time if they would go with him.

Mr. LUPTON (of the gas-works) then read a statement, which showed that the amount of gas manufactured for the week ending the 19th of December was as follows:—York Street, 6,475,000 cubic feet; Meadow Lane, 16,607,100 cubic feet; New Wortley, 10,802,300 cubic feet. In reply to a question, Mr. Lupton said that the amount which could be made and stored at present was 5,963,000 cubic feet, or 30 hours make.

Mr. WRAY said that on dark days more gas was required than they could make, but in the night they saved a little. Many a morning he had gone down to the works when they had not a three hours supply for the town.

After some further discussion the amendment was carried by a majority, and on the suggestion of Alderman GAUNT, it was agreed that the committee should also report on the average cost of gas at each work, the cost of collection, services, meters, &c.

IMPROVEMENTS IN WET GAS-METERS.

(WARNER AND COWAN'S PATENT.)

The measuring "drum," "wheel," or "cylinder," of a wet meter as ordinarily constructed is more or less affected by the variation of the "water-line," the rising of it lessening the capacity, and the lowering of it increasing the capacity, which arises from the measurer in action being but an annulus, by the water being above the axis of the wheel, hence the variation. A portion of all wheels around the axis is constantly immersed in the water, and thus the measuring portion of the wheel in action becomes an annulus, varying as the centre or dead portion of the wheel varies by the changes in the water level.

These improvements consist in the construction of a wheel, with an inner wheel of a little larger diameter than the dead portion of the wheel, within which the fluctuations in capacity of the combined wheels may take place, by which means perfect accuracy is practically attained, with considerable variation in the water-line and an increased range of float.

In one form, within the ordinary wheel is placed an inner wheel of the same make as the ordinary wheel, but with its inlets at the back of the measuring-wheel, and its outlets opening into the measuring chambers or quarters of the wheel. The radius of the inner wheel is a little more than the distance of the highest "water-line" above the axis of the meter. The small wheel, therefore, nearly corresponds with the internal dead portion of the ordinary wheel, and the depth of the wheel is that of half, or about half, the depth of the ordinary wheel. Now, as the inlets of this inner wheel are open to the case and common outlet of the major or measuring wheel, it will be seen that, as the major wheel revolves, the smaller chambers must be filled with measured gas; and as the outlets open into the large chambers of the measuring-wheel as they are filling, there must be, at each revolution of the wheel, a quantity of gas brought back from the measured portion equal to the capacity of the inner wheel; and as this varies with and is in the same ratio, and directly as the variable portion of the measures of the major wheel, there will be no practical variation in the measurement by variation of the water-line.

In another form, the small wheel is placed in the front part of the ordinary wheel, immediately under the cover. In this form the inlets of the small wheel are within the chambers of the major wheel, and the smaller wheel discharges its gas into the cover.

The construction of the chambers of the small wheel is the opposite to that of the usual wheel of ordinary construction, the gas being made to pass through the small one from the back to the front, the inlet-hoods (having no hollow cover) being thus placed at the back, and the outlet-hoods at the front of this wheel. The diameter of the small wheel must be such that the hoods may be always sufficiently above the water to ensure the compensating action of this wheel. There being two forms of the combined wheel—one with the ends of the two wheels in nearly the same plane at the back, and the other with the two ends at the front—the depth and diameter of the small wheel depends upon which of the two forms is adopted.

The combined wheel may be constructed with any convenient number of chambers, and the inner wheel may have a greater number of chambers than the major one, and be made in other forms than that of the ordinary wheel. A wheel may be constructed, too, combining the two forms; that is to say, with two small wheels placed within the major wheel, one with its inlets open to the chambers, and the other with its inlets external to the major wheel.

Instead of the inner or compensating wheel being within and attached to the measuring-wheel, a combination of an ordinary wheel with another of considerably less capacity, constructed in the usual way, the two being coupled together by spur-wheels or other equivalent mechanical means, may be used for extracting the compensating portion of measured gas, the smaller wheel being driven by the ordinary measuring-wheel at a rate proportionate to the capacity of the compensating-wheel, returning the gas thus from the outlet to the inlet of the meter.

These wheels may also be combined with Esson's or other compensating meters with fountains, thus permitting of a greater seal being given to the air-pipe of the fountain.

The principle of this invention will be best understood by a reference to the drawings attached. Fig. A is the ordinary wet meter "wheel," "drum," or "cylinder," geared to and driving in the same direction as itself, through the action of the intermediate or middle spur wheel, the small "wheel" or "drum" B. The construction, it will be seen by the dotted lines, as well as the movement, is the same in both A and B; but the arrangement of the chambers D and the inlets I and outlets O are reversed in B. The passage of gas through this wheel is, therefore, the opposite to that of the other. In A the flow of the gas is from the cover C, through the inlets I in front, to the outlets O at the back of the wheel; but in B the passage of the gas is from *i* at the back to *o* on the front. By the cover C and spout S, the wheel is in communication with the common inlet of the meter; the inlets of B, it will be seen, are common to the outlet of the meter. It is therefore obvious that as the measuring-wheel A revolves and discharges its gas into the case of the meter, a portion of that gas will be drawn from the outlet and returned to the common inlet by the wheel B. Now, as the depth of this wheel is equal to that of A, and the diameter rather more than that of the "water circle" or "dead portion," there will be at each entire revolution a volume of gas equal to the gas capacity of the small wheel, abstracted from the measured volume of the large wheel, leaving its measuring capacity practically that of an annulus, extending from its periphery to a circle corresponding with the periphery of the small drum. It follows, then, that the two wheels having a common water-line (subject to the difference of pressure in the two wheels), any alteration of it will equally affect their capacity, the lowering of the water increasing the capacity of both, that the excess of volume of the larger one will be returned to the common inlet by the correspondingly increased capacity of the small wheel, hence practically correct measurement is obtained with considerable variation of water-line.

Several arrangements of these combined wheels may be made. The two may be coupled together with their axes at right angles to each other by the use of bevel wheels, or they may be worked without the use of the intermediate spur wheel. In both these cases the wheels would revolve in opposite directions, and hence the common formation of chamber in the small wheel would have to be employed for the abstraction of the gas.

The two wheels may be placed on one "shaft" or axis with the covers C, C, at the two ends of the shaft, thus using the common form of chamber in the small wheel, the inlets of the small wheel being uncovered and the outlets covered; or, further, as the small wheel, B, is but a little more in diameter than the dead portion of the large wheel, a part of this may be cut away, without materially lessening its measuring capacity, and the small wheel placed partly or wholly, except the inlets, within the large one, thus economizing space, work, and material. Fig. 2 shows this arrangement. A is the "major" or measuring wheel; B, the small or "inner" wheel, as above explained, the action of which regulates the volume of gas passed to the burners from the major wheel. The inlet of the small wheel *i*, *i*, are nearly in the same plane as the outlets O of the major wheel, *i* and O being open to the outlet portion of case of meter. Each outlet *o* of the inner wheel opens and discharges the gas from its chamber into a chamber of the major wheel (while filling) as the same revolves, hence there is no necessity for a cover over the outlets of the inner wheel, or a spout and return-pipe, as shown in fig. 1, though the chambers are arranged the same. It need scarcely be added that the partitions P of the major wheel, and the quarters and outlet-hoods, are soldered to the inner wheel and made sound in the usual way, so as to form the four measuring chambers of the wheel,

Fig. 3 shows the major wheel with cover, C, and front quarters removed, by which a front view of the combined wheels is obtained.

Fig. 4 is a modification of the principle; the inner wheel is placed at or near the front of the major wheel, the inlets *i*, *i*, being placed within the chambers of the major wheel, the gas being discharged from the inner wheel through the outlets *o* into the cover chamber, C. The quantity of gas discharged at each revolution is practically the contents of the annulus, bounded by a circle corresponding with the periphery of the small drum, because the gas contained between the water-line and that point (in the portion of the large drum which the small one does not occupy) passes into the latter and is returned under the cover to be remeasured along with the supply entering by the spout. It follows that any alteration of the water level will affect both drums equally, and make no practical difference in the quantity of gas passed.

Fig. 5 is an arrangement by which the capacity of the measuring-wheel may be increased without increasing the size of the meter. The major wheel is made deeper by the convexity of the cover, C, being considerably reduced; space for the spout, S, is obtained by placing the front quarters of the inner wheel some little distance back in its rim.

In figs. 2 and 3 the inner wheel should be rather more than half the depth of the major wheel, and of sufficient diameter for the water to be no higher than the junction of the partitions with the inner wheel, as shown by "water-line." The depth of the wheel being rather more than half the depth of the major wheel, some allowance is made for the difference in capacity that would otherwise arise in the same sections of wheels from the difference in pressure at inlet and outlet by the action of meter, the chambers of the major wheel in filling being subjected to the inlet pressure, but of the inner wheel to the outlet pressure.

It will be understood that a perfectly accurate equivalent volume, with every change of "water-line," is not attempted to be withdrawn.

With figs. 4 and 5 the gas may be made to simply pass through the inner wheel, the inlets being subjected to the inlet pressure by placing them immediately behind instead of in advance of the partitions of the major wheel, the chambers of the two wheels then filling together; in this case the diameter may be less than the other arrangement, and the depth should be as great as can be conveniently allowed, but it will be understood that the patentees do not confine themselves exactly to any of the proportions given, and it may be found advantageous to make the inner wheels of greater diameters than those specified.

The two arrangements of wheels may be combined, that is to say, an inner wheel with its inlets external to the major wheel, and another inner wheel with its inlets internally arranged in the major wheel, and its outlets delivering into the cover chamber.

In fig. 2 the inlets *i* of the inner wheel are not placed coincident with the partitions P, in order that the construction may be better seen; but in the wheels of fig. 5, which is the form the patentees prefer using, the edges of the inlet-hoods are placed as close as possible to the edges of the partitions to which the inner wheel is attached. If placed in advance of the partition, as shown in fig. 3, the full measure of variable volume in the major wheel will not be taken out, and if placed behind it, unmeasured gas alone will pass through the inner wheel to and from the cover chamber C. In the latter case a "fan form" of wheel, as shown in fig. 6 and 7, may be employed as an inner wheel, it also may be used in the other forms, the object of all being the same, the withdrawal of a portion of gas after passing from the inlet, and returning to it again more or less of the gas in excess of the volume that should be passed to the burners.

The adjustment of the registration will be most conveniently made by changing the relative rates of wheels in the index.

The alteration required in a fountain meter to increase its efficiency by its adaptation to the improved wheel is to lengthen the "air" or "gas" tube, the bottom end being thus immersed to a greater depth in the water, with the same "water-line," the seal is thereby considerably increased to the range, or nearly so, of the variation of the water-line of the wheel, whereby the stability of the action of the fountain is improved, and the efficiency of the meter materially increased.

IMPROVEMENTS IN WET GAS-METERS. WARNER & COWAN'S PATENT.

(For description, *see* opposite page.)

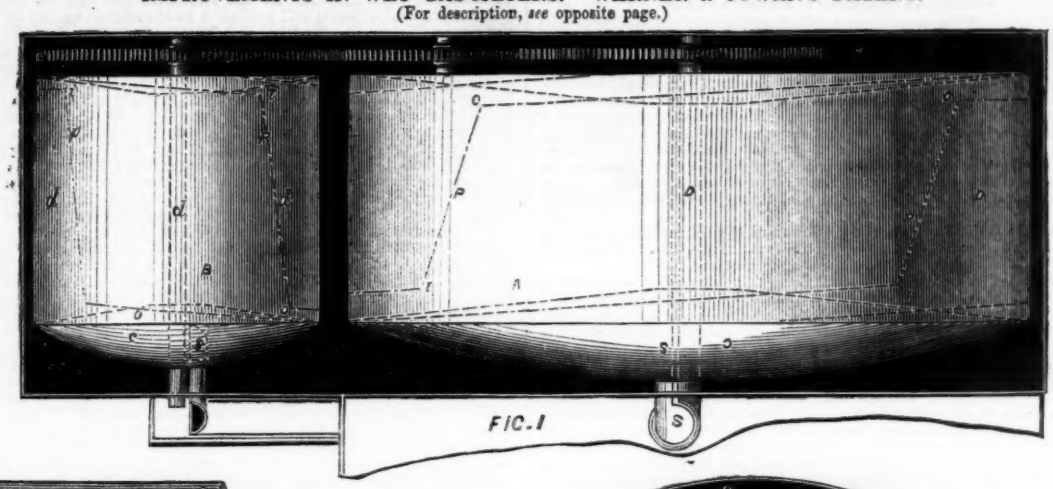


FIG. 1

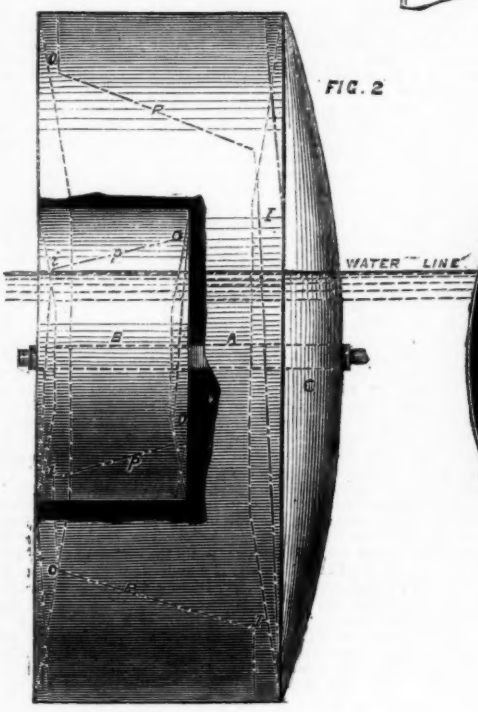


FIG. 2

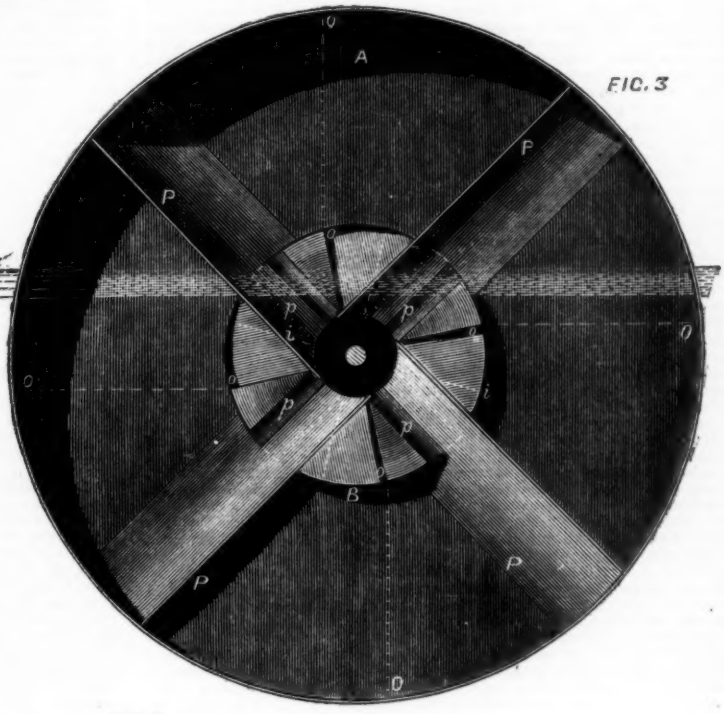


FIG. 3

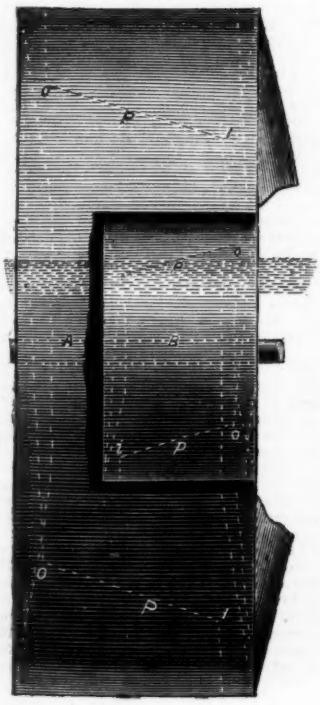


FIG. 4.

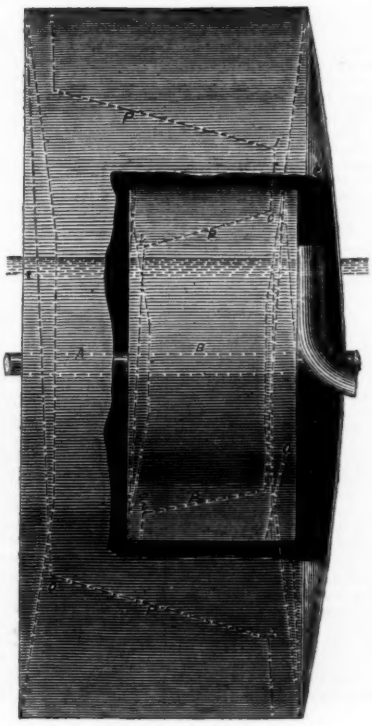


FIG. 5

FIG. 6

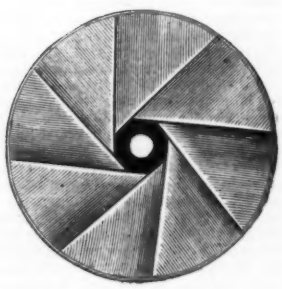


FIG. 7

AMERICAN GASLIGHT ASSOCIATION.

(*Continued from page 382, vol. XXIV.*)

Discussion on Mr. White's Paper on "Naphtha: Its Economy and Value as a Gas Producer."

Mr. Neal: I think the paper presented to us has been exceedingly interesting. It seems remarkable in Brooklyn that there is one company doing so well, and there may be others doing the same thing. I have heard of this process of Gale and Rand. I think I went to Saratoga and examined it, and in Brattleboro a similar process, and I was satisfied of its perfect failure. Now the writer of the article has something new, and I suppose that he will be glad to have us visit his works. How is that? Is there anything secret?

Mr. White: No, sir, we have invited you, through our president, to visit our works.

Mr. Neal: I would like to ask the gentleman what yield he obtains from his coal, how much to a pound, setting aside petroleum. Then what is the average candle power of the gas at the works, and at some distance from it?

Mr. White: I will say, in reply to Mr. Neal, that our average yield from a ton of coal is in the neighbourhood of about 12,340 or 12,400 feet to the ton; I think that will average about 5·60 to the pound. I do not call it to mind now, but it is just about in that neighbourhood. Our general average to the pound is about 5·50 to 5·75. As to the illuminating power, we endeavour to run in the neighbourhood of 17 candles, trying to get as near 17½ as possible. The gas was taken from the lamps upon ten different occasions, at different points in the district on the same night. The gas was tested at the works, where it travels four blocks before it gets to the photometer. In making our tests upon the gas I usually select some time during the hours of supply to the district, so as to obtain a fair test of the gas as actually delivered to the consumer. Upon these occasions referred to, I took at seven o'clock a test upon the photometer. I then sent out into the district men who gathered in bags gas from ten different points which I had selected as giving fair specimens of the gas from different points of supply. The gas was brought back and immediately placed upon the same photometer, and a record kept, and there was but a trifling variation found between the first test and the gases brought in from the district.

Mr. Neal: You speak in your paper of naphtha gas. Do you mean that you use clear proof petroleum or naphtha?

Mr. White: We use naphtha because now that it is so very cheap, petroleum of itself would be no inducement; but should naphtha rise to a very high price, we could use petroleum and still use the same process.

Mr. Neal: If the company that I represent were to use that process, would not the cost of manufacture be somewhat greater for the cost of the patent?

Mr. White: The cost of the patents of course would enter in. The arrangements made with other companies have been such that the cost of the patent has not been great or oppressive in any manner. The parties owning the patent right have been very liberal in their arrangements with the gas companies desiring to use it.

Mr. Neal: I would like to ask another question. Is this gas before us the article you manufacture?

Mr. White: I regret to say that the poverty of this gas is owing entirely to the fact that it is manufactured at the old Brooklyn works, under the direction of our friend, Col. Armington.

Mr. Cathels: I do not know whether the writer is quite at liberty to answer a question that I would like to ask, and that is, if he has kept any record of the difference between the registration of the station-meter and the returns of the consumer's meter?

Mr. White: I will answer that question with pleasure. I have said in my remarks that I consider a great many questions as to the cost of manufacture as being the private property of my company, simply because I knew that that article would be published, at least in the columns of the *Gaslight Journal*, and therefrom copied in various other perdioicals; but I am free to say to the gentlemen composing the association before me, that the Citizens Gaslight Company desire to retain from them no facts bearing upon the question under discussion, and we will give them the figures at our office, with pleasure. Our street lights are rated at four feet per hour. The station-meters and the returns received from the street lamps and consumers meters in the past year show a loss, I think, of 3¼ per cent.; it was less than 4 per cent.; that is, the unaccounted-for gas was less than 4 per cent.

Mr. Sutton: I think a year ago you used air.

Mr. White: Yes, a year ago we used air, which we were using merely for a temporary arrangement, until we could get our benches for the manufacture of water gas in operation.

Mr. Sutton: Have you discontinued the use of air?

Mr. White: Entirely so, for about a year.

Mr. M'Ilhenny: I have been very much interested in Mr. White's paper. Emanating from such a source, it not only partook of the beautiful, sentimental, and poetical, but it went further, and enlightened us upon the subject of the comparative value of coal and oil. I think that it is sufficient at least to stir up the curiosity and investigative ability of the members of this association, to ascertain whether or not the sentiments expressed here in this paper are sufficient to justify extensive experiments. There is no doubt there is a very deep and wide-spread feeling now, of investigation into the gas question. These feelings, however, arise periodically. They agitate the gas fraternity into various schemes, as our friend chose to characterize them, and are calculated to arouse the energy and inventive genius of those interested in the manufacture of illuminating gas. Such papers are always instructive, and coming from such a source as our friend, they have more weight than they would ordinarily. The paper is distinguished for its beauty. The gentlemen here will recognize the fact that all his acts pertain to that of the beautiful. When you illuminate a place, you always calculate to brighten the objects around you. If these things can be done more effectually with oil than they can with coal, I am certainly an advocate for the oil. However, it is a commercial question—one that the capitalists, the stockholders, and the officers of gas companies must go into, and with a seriousness that is beyond all mere verbal recitation of results. I say that this agitation of improvement and economy in the production of illuminating gas has been periodical. Since my boyhood it has been a familiar story to me. I have a limited experience in both processes; but I am not here to condemn any particular process. It is certain that these papers that are read here, and the opinions of eminent gentlemen are calculated to arouse, if no other result will follow, the energy of every conscientious and intelligent gas man who hears them. When a gentleman of character and truth asserts that he can produce, from certain materials, gas of a certain quality for 33 per cent. less than it can be produced from the materials generally used, it is worthy of serious consideration; and I think that if this subject is pursued, and a committee is appointed by this association to investigate thoroughly this question, the minds of those who are here now, and those who may hereafter belong to this association, will be relieved of any question of doubt on the subject; and of course if they were relieved of those questions, would at once launch into the manufacture of these cheap and very brilliant gases that are so represented here. However, there is one serious obstacle in my opinion—though this is not a fact, it is simply an opinion—raised against the universal use of oil gas. The production of petroleum, from what I can learn—I take one or two petroleum journals—is not increasing, but rather diminishing. If the gas world goes into the use of petroleum, the question arises in my mind—will not the commercial value of this article go up immediately and effectually check its use? There are always certain parties endeavouring to enhance the commercial value of every article. It is argued that the production of this article is inexhaustible. The facts show that it is not. No one who is familiar with the production of gas from oil, doubts that it will produce a most excellent quality of gas—that you can produce gas cheaply from oil. That is admitted, I think, by every intelligent gas man; but the question is, will the commercial value of that article remain the same, providing it is generally used? Supposing, for instance, that all the gas companies in this country change their works from coal to oil, how long would it be before the value of that article would be very much enhanced? Besides the cost of production is not so great as people suppose it is. I do not stand here to advocate coal, because I have no interest whatever in it. I may have some of the old prejudices in favour of coal that exist among gas people generally, but those prejudices are subject to removal at any time, when the evidences are presented that the supply of material will be constant and the same in price. The supply of coal we all know is abundant, and has been reduced in price. The cost of the production of gas from coal has been lessened, and the production has been increased. Now if this permanent and reliable source of production is thrown aside, and the gas fraternity resort to the use of oil, what will be the result? Will the oil remain at a permanent price commercially? I think not. In my investigations on this subject I found that the principal oil merchants in the country refused to contract for two months for a specific price. If that is the case with one comparatively small concern, what would be the result if the whole country used it? I think this is not a mere scientific question, but it is a commercial question—one that enters into the commercial value of the two commodities. Besides, as I said before, the reduction in the cost of manufacture is not so magnificent as some would suppose it to be. In the production of gas from coal you get a residual product. In the production of gas from oil none of these products come back. Now, until that question is settled, until the question of the supply of this article is settled, I do not think that it would be policy in men who have invested their capital in the supply of illuminating gas to the country to engage in it. I think as an auxiliary, instead of enriching coal, that oil will probably come in and supply the place; but when you commence to make gas of hydrogen, and carburet it with oil, you will then stumble upon the greatest difficulty that the gas fraternity ever encountered—that is, the supply and the cost. These questions are old, older than I am. There has been no improvement, in my judgment, in the apparatus for making oil gas since the time of Dr. White, in 1834. His apparatus was practically the same as those used at the present day; and as our friend has poetically illustrated, it is only the discovery of petroleum that has stimulated what he calls the inventive genius of the country to bring this question forward. If you look over the different contrivances from that day to the present, you will find that they are practically the same. I will take the privilege of alluding to the different processes referred to by Mr. White. The Gale and Rand process everybody understands. I visited Saratoga when that process was in operation. They wrote me a letter inviting me to come. I told them that I had been in the habit of visiting Saratoga for many years, and that I never was more gratified in the world than I was to be invited and my hotel bill settled; but I did not get any response. I went, however, with several gas men, and sitting in front of the hotel, we saw the lamps, and all of a sudden, like a will-o'-the-wisp, they disappeared. Well, that was stratification. I, with several gentlemen, got a room, and we invited the petroleum gentlemen to come forward and give their experience and the cost of production, &c. I make these remarks without any intention at all to reflect upon the remarks of my worthy and estimable friend here. In these investigations we had the gentleman produce his books, showing the amount of naphtha he used, &c. I had with me the statistics of the cost of gas in Washington, all the items in the cost of production, and we found that with petroleum gas manufactured in this way, 40 per cent. air and 60 per cent. naphtha gas, the difference in the cost or economy would not justify the great risk that was to be involved in lighting a city, because that is a point that the community has a right to be interested in. You cannot experiment on a community that are paying for an article, and expect a good article—you cannot experiment on them in justice. That is to be considered by every conscientious gas company. The result of these investigations in Saratoga showed that the difference in cost was very small. The result was that the whole thing was finally blown out, and they went into the coal gas again. Then again, Mr. Olney's process is a little different, if I understand it. If I am not right, I wish gentlemen would correct me. Mr. Olney's process is to produce both gases in the same retort, and mix them there, and get all you can from the coal, then to inject the carbon from the oil, and make a pure coal gas by the excessive carbon from the oil. That is the old story of making carburetted hydrogen. It is a mere chemical question whether you can produce carburetted hydrogen from the material that has it, or whether you can make it chemically. You make carburetted hydrogen anyhow in all these processes. Now the question is, can you make it cheaper and better chemically compounded, or can you make it better when Nature compounds it? Coal contains all the elements necessary to make carburetted hydrogen; and the question is can you make it better when you make it from the natural materials. I am one of those who do not emphatically believe in this age of progress. I think that there are certain things which cannot be done. These are times, it is true, of magnificent enterprises, great undertakings, wonderful discoveries; but notwithstanding these facts that we see patent before us, in the magnificent discoveries that we suppose to have emanated from this age, I am one of those who believe that they are mere recurrences of the past. Consequently I do not suppose, when such an abundant supply of coal is put at our command, that any other material will be devised until that is exhausted. These may be considered contracted, narrow views of the subject; however, they will in the end prove to be correct. The excitement in consequence of these various methods for the manufacture of gas from oil, as I said, is periodical. Your experience, Mr. President, is a living testimony to that effect. You have had instances, every four or five years, of the same thing. I recollect when I was a boy, in Philadelphia, when Sanders's water gas came out. I was then in a very subordinate position in the gas-works. The whole country was excited with this idea of making gas from water, and parties in Philadelphia having gone into it, and invested their capital, believing it to be a perfect success, the council in Philadelphia instructed Mr. Cresson, the very celebrated and competent engineer of the Philadelphia Gas-Works, to investigate the subject thoroughly, these works being owned by the city. Mr. Cresson being a thorough chemist himself, after investigation came to the conclusion that the whole thing was an absurdity, and pronounced against it. To illustrate Mr. Cresson's idea, the Girard House was lighted by the water gas. Mr. Cresson said, "If this is a better thing than the coal gas we want to know it," and he sent men there to cut off the supply of the city. I speak of this now to illustrate the result of these things. The parties got out an injunction. Mr. Cresson sent 100 men there and cut off the supply anyhow. The result was that the next night the Girard House was in darkness, and the chemist (Professor Doremus) who went from New York (I recollect reading the circumstance with a great deal of amusement) found out that the cock that had the oil on was turned most frequently, and the one that had the water on was turned very seldom. I speak of this now to illustrate what was the result of that excitement. Of course I do not pretend to say that the same result will ensue now, but I do say that there is this to be considered by the gas fraternity, and I am sure there is no gentleman here who has money invested who is not interested in this question, because money will tell upon a man quicker than any other argument. If you can prove to a man that oil is better than water, he will go for the oil; but if he likes water in his'n he will take it. Where coal is abundant and cheap, there can be no question as the economy of the two different processes. Where coal is high and difficult to procure, there is, of course, some argument in favour of oil. You may make oil gas on a small scale, and ma e it very successfully, but when you make 7

or 8 millions of feet per day, when you commence to light a city with these immense proportions, you have to dilute it with hydrogen or air; such hydrogen as you have to make out of steam, and some of them do not make hydrogen, although they think they do. When you do that I think you will raise a howl in the community that every gas man would try to shun. But, as I said before, no gas company has a right to go into these preliminaries until they know that they are a perfect success. They must not trifle with the interests and feelings of the consumers. Consequently, with all the respect that I entertain towards my friend and his intelligence, I do not think that he has convinced these gentlemen here, except in the simple assertion that he makes gas 33 per cent. less than it can be produced from coal. Now, I would like to ask our friend Mr. White, what would be the effect upon the commercial value of naphtha or crude petroleum, supposing that the whole gas fraternity goes into the business.

Mr. White: I shall endeavour to be as brief and concise as possible in my reply. I have to thank my friend for his very courteous recognition of the qualities that he supposes to be inherent in that paper of mine. His ringing the changes upon the old story of supply, reminds me of a story told of an old lady who lived years ago in Philadelphia, when the "black stone," now known as anthracite coal, was first introduced as a matter of fuel. The old lady looked at some of it. She had been used to those wide, hospitable, open fire-places, in which half a cord of wood had been thrown at a time, and the flames roared up the chimney, seeming to carry with them an invitation of hospitality spread abroad to all friends and comers. The old lady looked at this little bit of a coal fire in a grate, and she said, "Well, that may be a first rate thing for you folks that like to burn *stuns*, but as for me, God provides his forests for fuel and I would like to burn them, lest I be flying in his face." God did provide the forests, but the rapacity of man swept them away. God in His infinite wisdom provided inexhaustible stores of coal too, which lie under us in all directions. They stimulate all our enterprises, they minister to our social needs, they supply our daily wants. The whales that furnished the oil for the lamps of our forefathers were hunted from out the seas. Nature, or God, as we choose to recognise, came to the rescue, and out of the bowels of Pennsylvania and Virginia, and other States, lifted up the oils to replace those that were taken from the bodies of the leviathans of the sea. And do we too risk with the old lady the danger, in using them, of flying in the face of Providence? The stores of coal, gentlemen, are popularly supposed to be inexhaustible. If we have any geological knowledge, we know, if the stores of coal are measurably inexhaustible that the stores of oil are infinitely so; for wherever the carboniferous influence extends, there also oil will be produced. There has never been a demand in this world that was not met by an adequate supply. It seems to me that right here, in the city of Brooklyn, we can bring to you an illustration of this fact. One man, Charles Pratt, who is a large dealer in oils and the refined products of oil, has furnished, and agreed to furnish a very large quantity to several of our companies. The Mutual Gaslight Company use vast quantities of oil. The Citizens Gaslight Company use a somewhat smaller, but still for them a rather vast quantity. The People's Company of this city also use a large quantity, and the Harlem Company of New York also, and yet I assure you it has not raised a quarter of a cent; and we have made a contract—all four companies—with Mr. Pratt, for our supply of oil, at a ridiculously low rate for a whole year, and Mr. Pratt would be very glad to make contracts with all the other companies. As to the production of oil, I can assure the gentleman who has preceded me, that in the oil district of Pennsylvania, of which I know something, there is an inexhaustible store of this very commodity. So anxious are the producers to raise the price of oil in the markets of New York and Philadelphia to-day, that they absolutely stop work on wells, thus making a dead loss for the simple purpose of raising the price of oil. There is a constant demand in this country for refined oil, which will produce a constantly increasing quantity of naphtha. I did not presume, when I read my paper, that I should be understood as urging the use of oil absolutely alone. I spoke entirely of the use of oil mixed with coal gases, or taking the place of the rich and high-priced illuminating coals. I there advance certain reasons for objecting to the use of oil alone. And present to your minds as scientific and practical men, a field for future development. I should really dislike to emulate Mr. M'Ilhenny, in acknowledging myself in your presence as being an advocate of a belief, or want of belief, in an age of progress. I think that the time will come, and that within the life of every man within the hearing of my voice, when all this cumbrous machinery and vast expensive appliances will be swept away, and our gas be manufactured cheaply, beautifully, cleanly. Do any of you gentlemen, manufacturing gas from coal alone, invite your lady friends to walk through your works as I do? I say to my friends that they can pass through my works without soiling a single white garment. Can you do the same? No, you cannot. My process is the poetry of gas-making, as yours is the prose. And I assure you, gentlemen, that should I conduct you through my retort-house, which is now a "deserted village," more suggestive of a past busy life than that of which Goldsmith so poetically sings, and lead you into my naphtha gas-works, you would see a nicely dressed contented man, probably smoking a leisurely pipe, loooking as if he had nothing on earth to do to earn his daily wages, and yet he is making 300,000 feet of gas. This matter becomes important, Mr. President, on the question of commercial value, as suggested. Touch a man, as Mr. M'Ilhenny says, upon his pocket, and you touch the most vital instinct of that man. I have touched nine men upon their pockets, and they are pleased with my touching ways. It is a fact, gentlemen. Now, if these people, after 18 months of absolute hard work, and spending money in the plans and in the extension of the works for the manufacture of oil gas, can make, over and above that, the usual dividend, I certainly have uncompromising facts to be presented to you. Now I candidly say—I did not say it in my paper, for the simple reason that I desired to provoke this very discussion—come to our works. We will show you every record we have. I do not publish them as a public fact, but we will be glad to see you, and glad to present to you actual figures that you may see for yourselves if I do not make gas better and cheaper than we did before. Mr. M'Ilhenny, I know, represents a company that does make coal gas better and cheaper than any company that I know of. I speak from the card, for I know whereof I speak. But can any man pay 3·50 dols. for labour and 8·25 dols. for coal, besides paying for everything else in that proportion, and put his gas into the holders for less than 90 cents? I have done it, and I do it as a matter of record. I wish gentlemen to understand that every remark I make now is based upon a dead year; the dividends are paid, the books closed up. Gentlemen can draw comparisons with their own neighbours. I cannot, of course, compare with companies located in parts of the country where coal is 5 dols. in the sheds and labour 2·25 dols. Such companies must figure from a basis of their own prices, to obtain an idea of the gain to be made in their own cases. We can make no comparisons without being possessed of the facts.

Mr. M'Ilhenny: Is there any difference now in consumption?

Mr. White: I will say that our district now averages from 4 to 5 per cent. better than it did last year. We ought to add 10 per cent. to our consumption, but the trouble is in the general financial difficulties, and is not chargeable to oil gas to any serious extent.

Mr. De Mill: I would like to ask a single question. The gentleman says his works are open to everybody. I want to know why it is that right here, in the very city of Brooklyn, where there is one company doing like that, other companies have concluded not to use that process, but are using coal—right in his neighbourhood, right across the street—new works. I confess that I cannot understand such things, because if that is the best process for making gas, it certainly ought to be the best process in the city of Brooklyn, and the people who are erecting works, it seems to me, would adopt that plan. If that is the best plan, then it seems to me that the Manhattan Gaslight Company are blinding their eyes in the use of coal. The Metropolitan Gaslight Company of Brooklyn have erected new works in the last year, and they are making coal gas. I believe the Detroit Gaslight Company to-day have been for two years in direct competition with this very thing.

Mr. White: I beg pardon. It is not this very thing, but a different thing. You are in competition with the Gale-Rand patent, which is very different.

Mr. De Mill: Well, it is naphtha gas. I know it is better, and why I know it is better, there were gentlemen, the day before I left home, put your gas in at 1·50 dols., and they asked me 1 dol. for the other. Now, why is that?

Mr. White: I give it up—it's too abstruse.

Mr. De Mill: I will say right here, before I leave, that a vast portion of the gas sold by the opposition in Detroit is sold by my permission; in other words, if I go and say, "You must take my gas," they will do it, because it is a better gas.

The association then adjourned to meet the following day.

Thursday, Oct. 22.

The minutes of the previous session having been read and approved, the discussion of the Olney process was resumed by

Mr. Cartwright, who said: In connexion with the discussion of this subject, I observe with some degree of satisfaction the presence of Mr. President Libby. We heard from Captain White, I think, all the poetry and sentiment that is possible to be crowded into the subject, and I for one confess to a disappointment, under the feeling of which I would like to hear something that would come down to the substratum of the whole concern. We want to look at it in a commercial and practical point of view, and, if it would please the association, and at the same time Mr. Libby would be willing, I would be glad to hear any remarks he may have to offer.

Mr. Libby: If I can throw out some hints on this question which will be useful I would be very glad to do so. I represent no patents and no methods. I represent in what I say what to me appear to be simply facts and nothing more, and facts that I look at more in a business point of view than in the scientific light which you gentlemen give so much time and attention to. My attention was called to this subject through what is called the Rand process. I visited Saratoga with one of our most prominent directors, one largely interested in our company, and a man of clear and practical mind. We examined the process there, and he condemned it entirely. I did not. He condemned it so much, that he said he would not be willing to use it or invest any money in the development of it. There were others that were so strong in the idea that there was something in it that they were willing to risk something in the experiment, and in the development of what was deemed by many to be a grand improvement in gas-making. The idea which came to my mind was a commercial one. I found these facts existing in the manufacture of gas: that we were paying the Pennsylvania Railroad Company 6 dols. a ton for transporting a coarse, heavy material over the Alleghany mountains around to New York, an article that costs 1·50 dols. at its start, and 8 or 9 dols. when it arrives here; and when it comes here we use not over 20 per cent. of that product for the purpose of illuminating gas. Eighty per cent. freight and expenses were paid on this coarse material in order to get the 20 per cent. which we really need. It seems to me to be about as wise for an Iowa or Minnesota farmer to send his wheat straw here and grind it into flour, or as it would be for a Louisiana sugar manufacturer to send the sugar-cane to New York, and to manufacture it after it got here, and to pay the freight and expenses on the raw material. It seems to me that we have not yet got to the extent of our possible improvement; in fact, that we work very much behind it; that we ride in the stage coach and canal boat still, instead of availing ourselves of the more rapid transit—the railroad and steamboat. Now, if you take the amount of money which is consumed in freights, you will see that a very important item of the cost of gas is paid to the railroads. Then we come to the labour question, and we find as a matter of fact, and facts that cannot be disputed, that the old process at least costs more than twice as much as the new. These two items to a business man are formidable, and the question is: Can they be overcome? I spoke this morning to the foreman of the department of our works which is making naphtha gas. Our engineer is familiar with this; it comes to me now, because I spoke to him this morning about it. I said, "How much gas are you making per hour?" He said, "22,000 feet." I said, "Are you averaging 20,000 feet?" He said, "Yes, sir; we did that yesterday." We have four benches which make this 20,000 feet, and, multiplied by 24, makes 480,000 in 24 hours. That would be our maximum, perhaps, but 300,000 feet would be an easy day's work. It takes about four or five men to do this work. There is no labour in it; hardly any at all. The foreman sits there looking at his machinery, and one man keeps the fires; that is about all the labour connected with it. You can easily understand what it would cost to manufacture 400,000 feet of gas in the old way; you are all familiar with it. This gas we made yesterday is 18-candle power, measured by the photometer, and, combined with the coal gas, gave us yesterday between 16 and 17 candle power. I would not pretend to discuss with you, gentlemen, the chemical and scientific questions which relate to this, but, in a general way, I have always supposed and know that whatever is illuminating is in the carbon which the oil is largely possessed of. I consider that the hydrogen is a sort of express to carry along this carbon to the consumers; that it is carried as the sand is carried in the rapid streams, and is consumed at the point of the burner, and from that we get our light. The facts which were brought forward in Mr. White paper yesterday can hardly be disputed. They are the figures of our workings for a long time, and were simple facts, and pass for what they are worth. These facts seem to me to be very stubborn things, and I think they do not speak in very complimentary terms of the gas fraternity. Your honoured and esteemed president, in his opening speech yesterday stated, and stated truly, that a gas company was not a monopoly. In a legal sense it is not, but for all practical purposes it is a monopoly. No two gas companies can do business in the same place with profit. One or the other must yield, from the facts and surroundings of the case. Will you permit me, Mr. President, to make a statement, or give a reason, why the gas business must be a monopoly? It arises out of this fact—and I think this fact is universal—that the amount of capital required for a gas company in proportion to its business is so large that no two companies can occupy the same field. Banks, insurance companies, and other businesses have the world for their field. They can throw enterprise into their business, and extend it to any amount; a gas company cannot. Its business is fixed and it is local, and the amount of capital, compared with the amount of its business, makes it differ, it seems to me, from any class of business in the community. If Mr. A. T. Stewart, after he put a million of goods in his store, had to make a tramway to every customer he has, to send the goods home after they were sold, he would find that he had more money invested in his tramways than he had in the stock on hand; so that if you take the gas interest in the United States, with the amount of business compared with the capital, it would not be over 40 per cent.; hence the profit on gas must be very large in order to pay a fair return for the investment. Mr. Stewart (to carry on the illustration) may turn his stock eight or ten times a year, and if he makes 1 per cent. each time, he has made 10 per cent. We must make 25 per cent. in order to return the same profit, our yearly business being but two-fifths of our capital. And here is where the public do not understand and will not understand this question, that the per centage of profit in gas manufacture must be very large in order to give a fair compensation for the capital invested. This matter of monopoly is an important one, and your honoured president will excuse me if I say that, while it is not a legal monopoly (as any one can

make gas that pleases), it is practically a monopoly; and hence, unless the gas interest make some improvement—unless they afford a better light and a cheaper light—unless they advance as other departments of industry do, we shall certainly have just complaints against us from the community. I assert here from what I know, assuming that our gas is a good one (and I have no doubt about that), that there is a very great economy in getting the essential elements of which gas is made upon the spot, without paying this very large amount of expense in getting the coarse material. My own experience in the way of residual is, that those things do not amount to much in the end. They are said to be a profit. I do not think they are a very great income. They are often in the way, and I think that dividends upon residual are something as it was with the Morris Canal, in New Jersey, which never paid but one dividend, and paid that by mowing the towpath and selling the hay. I remember very well an anecdote related by a gentleman from Buffalo, who said that, while in England, he met an Englishman, and the conversation turned on the city of Buffalo. The Englishman asserted that it was in Canada; the gentleman of Buffalo said, "No; I am an American citizen, and I know Buffalo is in the United States." The Englishman said, "Excuse me; I have no doubt you think so, but still you must be mistaken." The gentleman said, "I have lived in Buffalo for 25 years, and I know it is in the United States." The Englishman said, "Excuse me; I have no doubt you think so, but you must be mistaken." Now, when these facts come out day by day, and month after month, as they do now, it strikes me as strange for gentlemen to get up and say there is nothing in it, as a gentleman from Washington did last night. The matter of the product of petroleum in this country has been brought up, and that is one that would attract the attention of all business men, and yet you would be surprised—I have not the figures—to see what a very small per centage of the amount of petroleum that is produced in this country—if all the gas companies were to use it—what a small per centage of that whole amount would be used, for it does not take a great deal of these oils to make 16,000 feet or a million feet of gas. We are getting about 130 feet of the average of this high quality of gas from one gallon of naphtha, day in and day out. This naphtha now is costing us 5½ cents on a year's contract, and it is easy for you, gentlemen, to state how much 1000 feet of the raw material will cost. If you add that we can make 100,000 feet a bench per day with four or five men, you will come very near to the cost of naphtha gas. There is a limit, however, when naphtha will advance in price. That we understand very well. But, situated as our works are, and as all the works should be situated, it takes only 48 hours to get back to coal again. If coal is too high, we go back to naphtha. There is another point in this which is a practical one, and that is some difficulty which has been had in regard to strikes in gas-houses. We had a severe one here in Brooklyn. Now, with us, if a strike should occur, we would take our engineer and clerk, and one man, and we would not leave our district in darkness. We can get along. We are independent, as far as that is concerned, of these dangerous strikes. I think that is a very important matter. Then, again, does it not strike all of you, gentlemen, that to go into a retort-house and see the men stripped to the skin—thermometer 100°—with wheelbarrows, rakes, hot coke, water, and steam, working 24 hours or 12 hours each, and then cipher down the very small product of gas to the man per day, it seems to be more like the toiling horses on the canal, than up to the advanced improvements in other departments of manufacture. I think, with all due respect to the gas fraternity and the distinguished gentlemen who are connected with it, that, with long experience, they are rather to-day the Marlboroughs in the field than the Napoleons: that there has been a later development of forces that have come to the surface, which must of necessity do away with old methods, while new ones and more scientific and better systems must prevail. I was somewhat surprised last night at the remarks that our engineer made in trying to urge this process on you. Gentlemen, I see no reason why he should do so. We are willing to give you any information we have, but to ask any of you gentlemen to adopt this method seems to me entirely outside this association. I would not ask any gentleman here to visit our works for our sakes; we can go on as we are going on. If we are dissatisfied with it, we can abandon it; and if we are satisfied with it, we can keep on with it. We ask you to come for your own sakes, not for ours. I do not know but that we would rather have you go on in the old methods, and let us go on in ours. I can see no reduction in the price of gas in this city so long as the present methods are followed.

Mr. NETTLETON: I want to ask Mr. Libby whether he has made a comparative estimate of the cost of the plan to carry on the naphtha works and the coal works; and one other question, whether the meters are the same, or whether they have been interfered with by the use of naphtha gas?

Mr. LIBBY: As our engineer said, since we commenced, more than three years we have been experimenting and feeling our way along. While we were using the process in which atmospheric air was a part of the gas, there was more or less difficulty with the meters. Since we have thrown aside the atmospheric air we have had no difficulty. Since I have been in the gas business, which is about 15 years, our office has never been so quiet; we are having few complaints, our meters register properly, and there is no trouble in the district. There is another matter, the naphthaline or crystalline deposit which some of our neighbours suffer with; we have none of this at all. We used to be troubled with it. In regard to the point of expense of the naphtha works, it is impossible for me to answer that question, because we had to take the old works as we found them; but it is easy to see that six benches do not cost us so much as 18; and in our retort-house, which is 200 feet long, and 65 feet wide, you will see, perhaps, eight or ten men at work in this whole stretch of retorts, and our consumption is a little under 500,000 feet a day.

Mr. LITTLEHALES: I must confess that I feel somewhat disappointed in reference to this subject. During the last six months, I venture to say, scarcely a day has passed but what I have thought over this question of oil *versus* coal, because I think there is no subject of so much importance—of such intense importance, I might say—to the gas world for two reasons—1. We want to make more profit for ourselves. 2. We want to be able to furnish gas at a less price. Now, any method or process to enable us to do these two things will be the best thing that can possibly befall us. I think, so far as the paper is concerned, it leaves us just as much in the dark as we were before. In fact, I do not see that it gives us a single grain of information. We have been told in a general way that the gas can be made for one-third less than coal gas. That may mean at one-third less than his gas was made before. That may not mean that oil gas can be made at one-third the cost in every place. What we want to know is the difference in cost of labour, in the cost of raw material, and what it will cost at the holder. Secondly, is the outlay for capital counted, or how is that in proportion to what it cost for coal gas. I must say the principal thing that drew me this long distance was to hear what was said in reference to this oil question. I came with this view, with this object; wanting to make gas cheaper and pay greater dividends, and sell gas cheaper to all parties. If any one can show me a process by which I may accomplish this—I don't want to take it for nothing—I will recommend my directors to give 50,000 dols., if it were necessary, to get hold of it, but I must know first of all that it is better, that it is more advantageous. If we can get something for 50,000 dols. that we can make 100,000 out of, I want to get it. Then 50,000 dols. profit is made. We were told in a general way last night that it could be made for something like 80 cents per 1000 feet, if I understood Captain White aright. I was told by a gentleman yesterday that he could make coal gas for 75 cents per 1000 feet. How is that? We want something reliable and something we can avail ourselves of, and act safely upon. Captain White seems to take shelter behind a screen, it appears to me. He said there were certain facts he thinks profitable to his company. I presume these processes are protected by patents; and if there be no objection that we know what they cost, then we shall know how we are getting on. If he can show us with a raw material at a certain price, then each of us can apply it to his own individual case, and we shall know what we are doing. But, in the present position, it seems to me that we are just as much in the dark as we were before the paper was read. Simple generalities have been presented. We want something more definite, with more information. There are a few points I would like to ask definite information upon. The committee that was appointed last night, it seems to me, would be equally unsatisfactory unless they can give us information on these points. One gentleman said they were not allowed to give us the facts and figures. Can this committee give them to us for publication? If Captain White was not allowed to give us the facts and figures, the committee will not be allowed to do so either. If not, the committee will be a perfect farce. I would like to know about those points, and if we cannot have them answered now, I would like to have the committee receive special instruction to get all the information they can on those points. The first is: Captain White says it has only been partially adopted. He said he would not recommend the entire abandonment of the coal process for that of oil. If he would not, why? If the thing is good up to a certain point, why is it not good all the way through. If it was only economical to make one-third of it, what is the reason? There is some reason; let us know what it is. Then we want to know the cost per 1000, subdivided into the cost per 1000 for raw material, the cost per 1000 for labour, the cost per 1000 to the holders; then we want to know the total receipt of the consumers meters—how much difference there is between the station-meter and the consumers meters. Then there is another thing. This same system, or as near as I can imagine, the same system of oil process, which, to my knowledge, has been tried in several cases, and in one case known to me, abandoned 15 years ago. They all seemed to carry out the same idea, getting as much gas as possible from the coal; decompose steam, and take the hydrogen and carbon and mix the two together. They all combined the same principle. I want to know, if this one is a success, wherein is the difference between this and all the others? I have not myself yet heard a single distinction pointed out between these two processes, or between this one and the 50 others that have gone before it. Captain White said last night that it is a totally different thing from that used in Detroit. Let us know wherein the difference is. Surely these things are protected by patent, and if any company thinks proper to take these patents up, let them pay for them. Let us have some firm ground to tread on instead of these generalities. Let us have something more definite. I may also say that this same thing has been agitated considerably in England lately, and a particular friend of my own, who has had some very considerable experience in it, gave me some facts and figures in reference to it; and although the company at that time was professing to make large profits, it was really costing them more for the gas than they were selling the gas for. I have the figures of what the labour cost, and they were actually selling the gas for less than it was costing them, and yet the thing was a success.

A MEMBER: Did they make any dividends?

Mr. LITTLEHALES: Yes, they were paying dividends. I want to know wherein this process differs from the dozens that have gone before it? And another thing occurs to me: If this is such a success, and it can be made so cheaply, how is it that these other companies in Brooklyn do not make their own gas from it? I venture to say that if I was in the Brooklyn Gas-Works, and I found that my neighbours could make gas so cheaply, if I did not adopt their process I would buy the gas from them. Surely there is some weak point—some screw loose somewhere. It would pay the gentlemen to lay a main across to New York, and supply the whole of New York, if they can do something that nobody else can do. I cannot see how it is that your neighbours are all so blind. I want to adopt this if I can. I appreciate the force of the remark of the gentleman that just sat down, as to the severe strain upon the stokers. It is a severe strain, and I would very much like to see some plan by which it can be avoided; if I can do so by adopting a cheaper process, I see a great advantage in it by lessening the labour, for it all comes down to dollars and cents. How are we going to make gas cheaper, sell gas cheaper, and make more dividends? A gentleman who has been quoted to me as a great authority on this question, Mr. Edgerton, I would ask to give me information on the points I have alluded to.

Mr. EDGERTON: I came prepared with a statement, which will occupy ten minutes, and which will refer sufficiently, I think, to the naphtha gas question which has come up within the last four years. Four years ago I made a report upon it, and I will quote somewhat from that report:—

ON PETROLEUM GAS.

By HENRY H. EDGERTON, Superintendent of the Fort Wayne Gaslight Company, Fort Wayne, Indiana.

Gentlemen,—I wish to occupy your time for a few moments to present to your consideration the following facts, not unimportant to you, as the representatives of the gas manufacturing interest. You are all perfectly well acquainted with the details of your own working, in your various localities, in regard to cost of materials, yield, leakage, &c., and all the accounts, in fact, that lead you to that interesting figure, the profit per 1000 feet of gas delivered to the consumer. Very few among you, perhaps, have tried any experiments with a view to making useful to you that not inconsiderable competitor of gas—kerosene oil. We had nearly all of us made up our minds, and that, too, very firmly, that petroleum oil, in every shape, under any name or synonym, was our enemy under all circumstances. Four years ago, the prospect of a rather lively competition with this enemy induced me to reconnoitre, from a new point of view, the position. The conclusions arrived at were embodied in a report, published in the *American Gaslight Journal* for April and May, 1871, which report is quite full on the subject.

The report and the conclusions arrived at caused the writer to be regarded as a decided renegade and traitor to the gas interest by all the orthodox people who took the trouble to read the report. Very few of you, probably, read it through, even if you commenced it. There seemed to be too much nonsense in it. However, I will not trouble you to go back to that. The main conclusion, in a nutshel, was this, that the best way to deal with that dirty enemy—petroleum—was to use it up. That is, use it to the extent of establishing an equilibrium between petroleum and coal as a gas producer.

In that report data were given by which I think any one of you could calculate for himself the point at which that equilibrium might be established, provided these data were received as true.

We of the gas interest generally thought this use of petroleum to be too much encumbered by the genius of "patent rights." We are all human, and therefore when one finds himself, as he supposes, the possessor of a new and brilliant idea—the hope of an admiring posterity—duty to one's family and the laws of his country induce one to rush in and take out a patent. It cannot, however, be contradicted that collectively we despise "patent rights"—we gas men particularly despise them. Some of us may have a remembrance of some other gas man paying for "Gengembre's patent non-freezing, non-evaporating, anti-corrosive meter liquid," together with an extra meter bill the next year; or for "linseed oil-cake purifying compound," one box warranted to last a year without change. This may bring us unpleasant reminiscences—let us pass on to main facts. The writer made sundry obstinate kicks at this "patent right" feature; but, adopting the French motto, "against force of circumstances there can be no resistance," he succumbed. Now, representing the principle, construction, and running of 22 gas-works using petroleum gas, both mixed with

other gases as well as unmixed, he submits to you the following facts:—Ordinary commercial naphtha, of average 70° Beaume gravity, makes 80 cubic feet per gallon of 80-candle gas; is composed of a mixture of four gases; when properly made contains no free hydrogen, no sulphuretted hydrogen, carbonic acid, or carbonic oxide.

It burns at the rate of 1 cubic foot per hour in a suitable burner, giving a light of 15 candles for 1 cubic foot; and, when free from any undecomposed vapour, the light is soft, brilliant, and perfectly free from smoke. The size of flame is 3½ in. spread by 1½ in. high. One of the constituent gases is a non-illuminant or diluent, one slightly illuminant, the remaining two—56 per cent. of the mixture—highly illuminant, of 1·272 specific gravity.

This gas is used unmixed in 14 cities and towns in this country, at prices ranging from 10 dollars to 35 dollars per actual 1000 cubic feet. About 2000 consumers think this gas a commercial article, and pay for it on the above terms. Among its consumers are stores, hotels, private houses, street lamps, and last, but not least, whisky shops, houses on the hill, houses in the hollows, with the same pressure. At present prices here, the commercial equivalent of 2½ cents worth of benzine, made into gas, is 400 cubic feet of 15-candle coal gas.

Thus you will see that our dirty enemy petroleum is greatly grown in importance with its increased volume.

Some consider that even a good thing may be too strong for weak knees and stomachs, and therefore put water in in. Consequently, no less than 28,500 customers of eight considerable companies are consuming this said to be uncommercial article, with more or less weakening coal gas, air, hydrogen, carbonic oxide, and carbonic acid in it. Now they like it, and seem to burn it, even where they have got a choice of a little more sulphur in theirs if they want it. Notwithstanding the combined efforts of these 22 gas companies, with their 30,000 consumers, and all other ordinary drains on our arch enemy, he still grows on us, as the price goes down lower and lower.

In the ancient times, when the big whales tried to beat out Boghead, or even Newcastle coal with their oil, aided by those pine country people with their resin, they totally failed.

Those of the ancient times remember well that fight, and with pride, too. Now whole counties are spouting oil in defiance, and it does look a little as if oil was raising right up on top of coal.

Then, why not investigate and look the matter up fairly, squarely, and fully.

To those who have attended to it—are certain they know all about it—I humbly address myself, with a request to compare notes.

If wrong, I am willng to turn again, enter the orthodox fold, turn off that naphtha gas, and quit.

I used to be a good coal gas man, and have an apparatus, very simple indeed, for unsealing the dip on hydraulic mains, and am ready to begin over again if necessary.

In regard to the price of the manufacture of this gas in different localities, and the cost of materials, there are certain fundamental data on which to base your calculations. The cost of labour for making you will have to ascertain comparatively, and make your estimate on it by visiting such works as are using it, and apply to the labour there the price that you are paying for labour. That I think embraces the foundation of the naphtha gas question at present.

Mr. Sutton: I would like to know from Captain White about how he would advise us to make gas, how much coal gas, how much hydrogen gas, and how much oil. I would like to know what it is, and so would other gentlemen. I want to know the practical part of it. I do not despise information from any source where I can get it.

Mr. Neal: At our meeting yesterday there was a committee appointed on the subject of naphtha gas, of which I am the chairman. When are we expected to report?

The President: It depends on the committee.

Mr. Neal: Not at this meeting?

The President: It is not obligatory.

Mr. Neal: I have been lookng at several works where naphtha is used, and I am entirely in the dark yet, and I do not think we can make a report until the next semi-annual meeting. I would say as chairman of that committee, that we are not so well prepared to report as we were yesterday afternoon. We have been looking into the subject, and we are seeking for light, but we are all in darkness. I speak and act for other members of the committee. I think they are of the same opinion. We ask for further time. We ask permission to report at the next semi-annual meeting, six months hence.

It was moved, seconded, and resolved that the request be granted.

Mr. Littlehales: I beg that the committee be specially instructed to inquire as to the different cost, so that we may have reliable data.

The President: If any one is desirous to draw the attention of the committee to any particular point, he had better submit it to the chairman of the committee in writing.

Mr. Bexter: I had not intended to make any remarks at this time, but I feel, coming from a portion of the country but little represented here, that it is proper for me to say that I appreciate the attempt of the gentlemen to introduce to us a new process for the manufacture of gas. While it may be unsatisfactory to us, to very many of us, yet we must feel under some obligation to these gentlemen for introducing this matter for our consideration. The novelty of it takes us almost by surprise, and we are unprepared for it. When we make comparisons between our process which we have followed for years, we cannot at first see the great advantage. These gentlemen say they can see it. The company which I represent is one that is doing to-day no larger business than it did in 1860, yet our business is much more profitable to the company by reason of the improvement of the manufacture of the gas and lessening its cost. We are anxious to become more economical in the manufacture, and reduce the cost to the company as well as to the consumer; and for that reason I am here with the hope of gaining valuable information for myself, for the company I represent, and for the general benefit of the fraternity in my section particularly. I have simply made these remarks so that I may not be understood as making any reflection upon the gentlemen who have preceded me, or those who represent an interest different from that which I represent. I am anxious to gain information, and to make that information valuable to the interest I represent. We have had some figures presented as to the quality and quantity of coals. I do not know that it is desirable at this time to view them at all, as this matter will be presented by the committee at our next meeting. I had hoped, if it were possible, that we might have a report at this meeting, and the comparisons as to the cost in various parts of the country might be brought before us. It is said that coal in New York costs 8 dols. 25 cents per ton. In some sections of the country it does not cost much more than half that amount. The quality of the coal is, perhaps, different. The Virginia coal, which I am compelled to use, some 20 years ago probably you will remember, was rated at about 3 feet to 3½ feet to the pound. We now, under better processes, get from 4 feet to 4½ feet, and in some cases 4½ feet to the pound. We consider that a great improvement, but we want to do better. The cost of labour is another matter. Here, in your great centre of activity, labour is costly, while in other portions of the country labour is comparatively cheap. As we met here for information, it is not only desirable that comparisons should be made in the city of Brooklyn, but in other portions of the country. In Virginia we have coal, but not oil. We would have to transport the oil from Philadelphia or Baltimore to the southern parts of the country, where we have coal near at hand; so, in some portions of the west, the comparison between the cost of coal and oil in those portions would be very different from that of the oil centre and far from the coal centre. I hope the committee, in making these investigations, and making their report, will take into consideration the various circumstances of the nearness to and distance from the various materials. The process I will not speak of at all. I have had some little experience in these matters in years gone by; this has led me from one time to another to disappointment, and I hope the time is approaching when our disappointments are to end, and we will come to the determination of what is the best material—and that inexhaustible—to make gas of.

Mr. Cathels: I simply want to ask a question of the Citizens Company, if I understood it correctly, that five men were engaged in the manufacture of 300,000 feet of gas, or ten men—five in the day, and five at night.

Mr. Libby replied by saying it was four men.

Mr. White: As my paper seems to have been the source whence all this discussion has sprung, I would like to call the attention of the association to some remarks made in that paper. I spoke, in the opening of the paper, of the fact that I knew I should be travelling upon a dangerous and much disputed ground in entering at all upon the discussion of the subject. I further say in the paper that we have no desire to proselyte any company in the country. I was simply relating in that paper the result of the experiments made at our works, and the general benefit we had derived therefrom. There are some points, however, which have been raised, and some questions asked here this morning, which I feel it is due to myself and the association to reply to. I did not, as I stated in my paper, give you actual figures of the results at our works. I did not, for two reasons—one that they might be brought out in discussion, and another that it would be almost impossible for me, within the limits of that paper and of your patience, to go into any extended and tabulated defence of the subject of the paper. I made the bare assertion in that paper, that my company were manufacturing gas cheaper and better than they ever made it under the old working. I claim that we put the gas into the holders, as I said, at about one-third less cost than under the old process, in round numbers; probably it will not be within a cent. or two of exactly one-third, but it is in that neighbourhood. The absolute figures are withheld, for the simple reason that I did not wish to make the fact a public one. Among ourselves I am willing to give any facts to be used, to convince the gentlemen actually interested in this matter. Any facts that are necessary for such information we would cordially extend to them, upon a visit to our works, or here in discussion among ourselves. The point that Mr. Littlehales makes is a good one, upon the question of labour and the general saving, and it is one that I feel perfectly at liberty to reply to. It seems to me, that I can come here upon my authority as engineer of my company, and upon my known reputation among you, as I think, as a gentleman of probity, and assert that our pay roll—an indisputable thing—demonstrates the fact that we have reduced the labour in our works fully one-half—and I say to you, gentlemen, that instead of running 20 or 25 or 30 benches of five retorts each, we made all the gas we wanted, in the press of last winter, with ten benches of four retorts, and two benches of naphtha and two of water gas, making altogether fourteen benches, our daily consumption being that winter in the neighbourhood of 1,000,000 feet of gas. Last winter it was a little less than 800,000, but the gas was all made from fourteen benches. It is not necessary for me to say to those practically engaged in gas-making how many men it takes to run 14 benches. You know that about as well as I do. In making the assertion that we make gas for 80 cents. per 1000 feet, and put it in the holder, I know that strikes a great many gentlemen as not a remarkable exhibit, but the gentlemen must take into consideration the facts under which we work; that in the large cities where labour is high, we cannot compete with you who are differently situated on the question of labour; but take your own price of coal—take the cost of naphtha—reduce your labour one-half—reduce the quantity of coal you use one-half or nearly so, and then see where you will reach in your figures. I cannot, of course, stand here to-day and say we make gas for such and such a price, and have a gentleman rise up and say we can do so and so in our country without the naphtha gas. That gentleman is talking of labour that may only cost him 2 dols. 25 c. a day, and coal that may cost him 4 dols. 50 c. in his retort-house. The remarks I made last night were based upon the past year's business, when labour cost 3 dols. 50 c., and coal cost 8 dols. 25 c., and I am now speaking of a past and closed year's work. If this thing was fallacious, I certainly desire its fallacy pointed out. If I can deceive a body of stockholders composed of prominent business men, and a board of directors, than whom no shrewder business men are engaged in our profession, and if I can deceive my much respected and very able president, I am a sadly underrated man outside. If I have gone on in my works for twenty months, and studiously and successfully deceived my people, and yet paid them larger dividends than they ever got before, I think I am a very successful and underpaid gas engineer. Money is the test of this thing. We have gone on, month after month, at this business. We have lessened our expenses of working—have paid our regular dividends, paid our current indebtedness, and owe no man anything. Could this be done in working a non-paying concern? I venture to think not; the money must be earned before it can be expended or divided. Touching upon some points of Mr. Littlehales, as to why I do not describe fully the method we employ in manufacturing, I beg to call his attention to my description in my paper of this very matter; I cannot be more explicit, so will not now try. As to the fact that failure has followed failure, and scheme followed scheme, to a common result, it is neither here nor there. I admitted that all this was true—that men had crossed and recrossed this ground until it was a confusion worse confounded of patented failures; but claim that the richest fruits of invention and thought, like those of nature, come from ground vivified by the very process of decay. Again, I am unable to say why the other companies of Brooklyn and New York do not follow us into this new field any more than I can account for some of Mr. Littlehale's own views. This I do know, truly, it is a knowledge we all show, that men will differ upon facts as well as upon theories, no ten men seeming to see a thing alike from any one point. When gentlemen will prove that gas-lighting is a failure, because Sir Humphrey Davy said it was impossible to light London, and that the railroad is not superior to the canal boat, for rapid transit, because many good and thoughtful people once believed otherwise, or explain why all changes meet just this species of attack in their outset, I may be sufficiently enlightened to tell why other companies do not join this movement, but I can cipher up their loss in waiting for some others to ford the stream. I did not claim nor do I claim that these workings are perfect, or that we had reached the limits of this investigation. I was very glad to meet Mr. Edgerton this morning, and hear him say what he did. I feel with him that we have just entered into a field in which I frankly believe the next great change in our process of manufacture will occur. It does seem to me, that without giving the gentlemen engaged in our business the absolute detail of fact here, these assertions, for they cannot be disputed, ought in a measure to suffice. If it is necessary, I have the exact details of every portion of our manufacture, and can give them. There is no intention of deceiving you; there is no desire on my part to lead you into this thing. I should not gain one penny if every gentleman in the room purchased the right to manufacture. It is of no value to me, but as a member of the association, and on your invitation, I have written a paper on the subject, and I have done it in that spirit of frankness in which I expect to be met by you all, and in which I expect to be dealt with here. If, in closing, I have neglected to meet all the questions asked, it has been from no desire to screen myself, as has been charged, behind glittering generalities; I made no notes of the argument of others, so will answer any further questions, if the desire still exists or your patience lasts.

(To be continued.)

NEW JOINT-STOCK COMPANIES.

Brought out in the Year ending December 31, 1874.

(*From Messrs. Spackman and Sons' Tables.*)

Name of Company.	Capital Authorized.	Capital Offered.	Amount of Share.	Deposit.	Total Deposit.
	£	£	£ s. d.	£ s. d.	£
Autogen Pure Gas (L.)	24,000	24,000	1 0 0	0 10 0	12,000
Bohemian Gas (L.)	100,000	50,000	100 0 0	50 0 0	25,000
City of St. Petersburg New Water-Works (L.)	200,000	200,000	20 0 0	5 0 0	50,000
Eupion Fuel and Gas (L.)	50,000	50,000	1 0 0	1 0 0	50,000
Sanitary Milk (L.)	200,000	50,000	1 0 0	1 0 0	50,000
Saratov Water-Works (L.)	180,000	120,000	20 0 0	5 0 0	30,000
Universal Disinfector (L.)	60,000	45,000	10 0 0	2 10 0	11,250
West Berlin and Potsdam Water-Works (L.)	250,000	250,000	10 0 0	3 0 0	75,000
Whitley Partners	150,000	75,000	10 0 0	3 0 0	22,500

NEW ISSUES OF CAPITAL DURING 1874 BY COMPANIES PREVIOUSLY EXISTING.

Name of Company.	Capital Offered.	Number of Shares.	Amount of Share.	Amount Called up.
	£		£ s. d.	£
Cadiz Water-Works (L.)	69,600	—	Stock	69,600
Foreign and Colonial Gas (L.)	15,000	1,500	10 0 0	7,500
National Water-Works of New York	160,000	—	Stock	148,000
Peoples Gaslight & Coke Company of Chicago	420,000	—	Stock	84,000

THE SEWAGE WORKS AT KNOSTROP.

[Extracted from the *Leeds Mercury*.]

Since our last notice of these works they have been reconstructed on such an enlarged scale as to deal with the whole sewage of the borough, amounting to no less than 12 million gallons daily. The new works were commenced in August, 1872, and have already cost about £60,000, including £20,000 for the 10 acres of land which they occupy. So large an expenditure is alone sufficient to induce ratepayers to interest themselves in the subject, and their concern in the matter is further increased by the prospect of having to spend from £10,000 to £20,000 per annum in carrying on the works. As a consolation for this large expenditure, a material set-off may be expected in the way of sanitary advantages, including the sadly needed purification of the river Aire, to which the Town Council is still urged forward by a Court of Chancery injunction.

It will be remembered that in 1870 an agreement was made with the Native Guano Company to treat a certain portion of the sewage experimentally by their A.B.C. process, so called from the use of alum, blood, and charcoal as the precipitating ingredients. The cost of the process was found, however, to be much more than had been anticipated, with the further drawback that the value of the residuum mud fell far short of what had been predicted. Certain rights being reserved, the Native Guano Company were therefore released from their agreement with the corporation. Subsequently, the old works were placed at the service of parties wishing to conduct experiments. Amongst those who took advantage of this opportunity was General Scott, the special feature of whose system is that he converts the residuum into cement. More recently, experiments have been conducted by "The Clarifying and Utilization of Sewage Company, Limited," who are the proprietors of Mr. R. Goodall's and Mr. Fulda's patents. For the past three months the committee of the Town Council have entrusted the works to that company, and their term has now been extended for a further period of three months. In these circumstances, it may be of interest to give a brief description of what is going on at the new works, adding, by the way, that they will serve for any system of precipitation.

The site of the new works is near the old experimental tank at Knostrop. The main building is three stories in height. On the ground floor there is an engine-house, fitted with two pairs of new horizontal pumping-engines of 40-horse power each, and a single horizontal engine of 25-horse power, the latter having been in use at the experimental works. Here there are also a special pump for pumping water from a well into an iron tank, forming the roof of the mill-house, from which the boilers, &c., are supplied, and two large centrifugal pumps for pumping the sewage up from the main sewer into the tanks to be dealt with there. Next to the engine-house is the boiler-shed, fitted with four two-flued boilers, each 30 feet long and 6 feet 6 inches in diameter. Two of the boilers are provided with Gall's (Halifax) patent smoke consumers. Also adjoining the engine-house is a compartment containing five wrought-iron cisterns, placed there for the purpose of receiving any materials which may be necessary for use in the process of "precipitation." On the floor above this room is a large oak cistern, used under the A. B. C. process, for placing the alum, one of the ingredients used in that system, and now to be devoted to the holding of an ingredient used in the process to be adopted—viz., a liquid preparation of iron. In the room above this—the top floor—are fixed the grinding-mills for grinding the ashes, lime, charcoal, or other ingredients used in the process of "precipitation." There are also a warehouse of three floors for storing the materials used in treating the sewage, a shed for storing and slaking the lime, together with a chimney 150 feet high, with moulded base and ornamental cap. Outside the building are the settling-tanks into which the sewage, after being mixed with the ingredients used in precipitating the solid matter, is run. Those tanks are 12 in number, and are arranged in two parallel rows of six each, with a double channel between them. The tanks are all of an equal width—viz., 60 feet, and 11 of them are 100 feet long, whilst the twelfth is 88 feet long. Each has a capacity of a quarter of a million gallons, making a total of 3 millions. Formed on a bed of concrete and puddle, finished with strong pitching, and having ashlar coping, the tanks have a massive and durable appearance.

The ingredients used in the process, by the company now in possession, are lime, carbon, town ashes, and sesqui-persulphate of iron. After these have been ground together, the dark paste which they form is shot down to a receptacle at the outlet of the main sewer (itself 8 feet in diameter), from which there is a continual and rapid flow of black and foul-smelling sewage. This compound is then lifted by the centrifugal pumps into the three mixing tanks—each 10 feet in diameter by 8 feet in depth, and each fitted with an "agitator"—an upright shaft with two revolving arms—which thoroughly mixes the chemical preparation with the sewage. The entire mixture is then conveyed to the first of the settling-tanks, and so on by gravitation from one to another of the series. The circulation is maintained by gravitation, the partially purified surface water from one passing on to the lower level of the next. By an ingenious arrangement of sluice-boards the sewage from the large pipe, already mixed with the ingredients that are to effect the "precipitation," may be conveyed by the central channel to any one of the tanks direct, so that any one of the 12 tanks may be taken at any moment, and, without at all interfering with the work going forward, may be emptied of the residuum or repaired as necessity may arise. In ordinary circumstances, however, the tanks are not filled direct from the channel. The usual method is to raise the sluice-board of the first of the six tanks on the right, and to let the sewage flow from the channel into it alone, each of the other tanks being filled by the overflow from the tank preceding it. This is secured, as we have already indicated, by having the level of the lower end of each tank two inches beneath the level of the upper end, thus securing the circulation of the fluid by gravitation. By this simple but ingenious arrangement this important result is obtained:—The sewage in passing over the first tank will have parted with a portion of its solid matter, and hence is partially purified when it has reached the second tank. Again, in passing over the second tank it leaves behind it a second instalment of solid matter; so with the third and each successive tank, until it has circulated through them all, leaving a deposit at each, and at last flowing from the twelfth tank in a clear stream, in a condition to pass into the river without polluting it. One point of which there can be little doubt is the quality of the effluent. The result attained in this respect appears all that could be desired, the water being remarkably clear, and smelling only to a slight extent of lime.

Two considerations not yet clear are, the value of the residuum mud, and the total cost of the process. From the result of an analysis, it is claimed that the residuum would be useful as manure; but this has not yet been put to a practical test. Another suggestion is that it might be ground again and mixed with more or less addition of fresh chemicals to the incoming sewage, so as to utilize to the utmost the ingredients held in suspension by the solid matter, and precipitated to the bottom of the tanks. Each million tons of sewage contain about five tons of solid matter, and no less than seven tons of the precipitating ingredients have to be mixed with this quantity in order to purify the whole.

With regard to the cost of the process, it is not yet possible to speak of the future with certainty, there being some expectation that the expense may be somewhat reduced when the works are in full operation night and day, as they may soon be, instead of only at daily intervals. Meantime it is estimated that the chemicals alone used in precipitation cost nearly £2 for each million gallons of sewage treated. The working expenses are likely to amount to as much, making a total expense of probably not less than £40 per day, which, with the interest on original outlay, would bring up the amount to between £15,000 and £20,000 per annum.

The contractors for the new works at Knostrop have been—Messrs. Longley Brothers, Hunslet, the buildings and tanks; Messrs. J. and H. Horsfield, the engines, iron cisterns, two of the boilers, shafting, &c.; Mr. Taylor, iron-founder, Kirkstall Road, sluice-boards; Mr. Nichols, Victoria Foundry, Hunslet, the valves and connectors; and Mr. James Craven, of the Borough Engineer's Office, has been the clerk of the works.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There has been very little done at the local iron-works and foundries since my last notes were penned, owing to the holidays, which commenced on Christmas Eve, and will not, in many instances, be terminated before this Monday or Tuesday.

There have, in consequence, been very few transactions in ores or in any description of manufactured iron, except certain kinds of foundry work for repairs, which are generally reserved for periods such as these, when the machinery is at rest. Taking the year as a whole, the foundries have not had so much to complain of as some of the other heavy departments of the iron trade, but it is an undeniable fact that matters have at length come to a pass which renders it to a great extent problematical as to what the next few weeks may bring forth. At one or two establishments there is still a fairly good production of large-sized pipes for gas, water, and steam purposes, as well as articles for use in various branches of the building trades. There is also a moderate amount of business at the works where gasholders and miscellaneous fittings are made.

The Rotherham brass-works continue to receive numerous favours of good proportions for bib, ball, and other cocks, for hydrants, fire-plugs, high-pressure meters for water companies, patent water-closets, closet-fittings, and plumbers brass work generally, as well as certain kinds of engine-brasses and steam-fittings.

Messrs. Moss and Gamble, of Russell Street, Sheffield, have just shipped several large-sized connecting-rods and beams which they have made for a German water-works. They are wholly constructed of wrought scrap iron, and weigh about 3½ tons each.

There is not a very brisk inquiry for steam or miscellaneous kinds of manufacturing coal, hence prices are easy. Owing to the very severe frost, house coal is in great request, and at full prices.

From the same cause, navigation on the canal between Sheffield and the port of Hull is suspended, causing the usual coal, &c., traffic along the route to be wholly suspended.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

Though business has been nominally resumed after the holidays, there is very little doing in the finished iron trade of this district, and the uncertainty as to the course of prices on quarter-day is much increased by the recent severe weather and the consequent improved demand for coal. There is now little doubt that there are numerous orders in the market which are still withheld in anticipation of easier rates, and the prospects of business for the new year are not without some features of encouragement. Messrs. Barrows and other leading firms have already intimated their intention of adhering to existing rates, but it is not improbable that they will accept the decision of the general meeting of the trade on quarter day. Sheets are still in active demand for galvanized roofing purposes, and some large orders for this description of iron have been booked during the past week, on account of the Australian market. Nail-rods also command a steady inquiry, and the general hardware trades of the district are brisk, but there is very little doing in heavy engineering ironwork.

Pig iron is still firm, with little prospect of reduction. Native ironstone being very scarce, two furnaces have already been "damped down," in consequence of deficient supplies of ore. The serious interruption to the mineral traffic, caused by the severe frost, is also much restricting operations at many of the smelting furnaces.

The coal trade is much improved, and prices have an upward tendency. For household qualities there is a very brisk demand, and dealers have considerable difficulty in satisfying the requirements of their numerous customers. Coke is in improved request, and the local gas companies now find a ready market for this product. The new board of examiners for managers under the Mines Regulation Act has just been formed, and the first meeting was held on Wednesday last, but the proceedings have not been permitted to transpire.

THE COAL AND IRON TRADES OF LANCASHIRE.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of this district may almost be said to have been in a disorganized state in consequence of the impossibility of bringing anything like adequate supplies into the market. With one or two exceptions, the block in the railway traffic, to which I alluded in my previous report, has shown little or no improvement, whilst in some cases, notably in the Wigan district, matters have been aggravated by the railway companies declining temporarily to take any coal traffic whatever. The transit along the canals for any long distance has also been rendered impossible in consequence of the block caused by the ice, and the frozen state of the roads has equally interfered with the cartage of coal from the collieries. There has been the greatest pressure on the part of the gas companies to secure supplies, and colliery proprietors who were able to offer

anything in this class of fuel could command prices very considerably above the current market rates. So far as house coal is concerned, the demand is so much in excess of the supplies, that all the principal colliery proprietors are very far behindhand with their orders, and although no alteration has yet been made in the last rates, further orders are in many cases only being accepted subject to the prices which may be ruling when the deliveries can be made, whilst merchants and dealers are already obtaining very high prices for deliveries. In fuel for manufacturing purposes, supplies have also been deficient, and at present there is an indisposition to renew contracts that are running out. In the present state of the market, it is of course difficult to say what turn prices may take, for although odd purchases for small quantities can in many cases only be placed at higher rates, it is scarcely probable, unless there is a long continuance of the severe weather which has been experienced during the past few weeks, that there will be any material advance in the present list rates.

The pits have, as a rule, ceased work for the new year's holidays, and there will not be much work doing amongst the colliers for a week.

The local coke trade continues to exhibit a little more activity, but it is probably owing to the desire on the part of consumers to take in stocks just at present, and also to the difficulty in obtaining north country cokes.

In the iron trade there has been little or nothing doing during the past week, and prices are nominally about the same as last reported. The various iron-works have been stopped for the holidays, and it is not expected that much actual business will be done until after the result of the quarterly meetings is known.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The continuance of stormy weather, with snow and frost, tends very much to derange the shipments of gas coals on the Tyne, Wear, and adjacent ports. The difficulty between the North-Eastern Railway Company and the collieries, with regard to keeping up an adequate supply of waggons at the pits for loading, is unaltered. In consequence of this condition of things, and notwithstanding this is the busiest time of the year in the gas coal trade, the Durham pits have been working very irregularly, and many of them have been doing little better than half time. Indeed, some of the leading collieries have experienced a considerable difficulty in keeping their own steamers going, whereas a good few sailing ships have been put upon demurrage, and most of the colliery offices have given an intimation to merchants that they cannot be bound with regard to the number of lying days, as the shipments, to some extent at present, are beyond their control. The household coal trade of the North of England is extremely firm at present, though, at the same time, and notwithstanding the extremely inclement weather, there has been no sudden rush up of prices. The highest figure attained at the pits does not exceed 17s. per ton, the average, however, is not above 16s., and a good quality of medium household coals may be bought at 14s. The steam and general manufacturing coal trades are very much depressed. There is little demand for steam coal at present, and manufacturing and small coals continue to be a complete drug in the market. Manufacturing coals may be had in abundance at from 5s. to 6s., and small coals from 3s. to 5s. per ton.

There has been during the past fortnight a very excellent supply of coasting tonnage in the coal ports, which has just met the demands of the merchants but no more. Freights have kept very firm. At present the rates for sailing ships to London range from 7s. to 7s. 3d. for sailing vessels, and from £9 to £10 10s. for the Channel ports. All the ready ships that come to hand are taken up at these figures.

The iron trade of the Cleveland district continues in an extremely depressed condition; the market was decidedly weaker in the last week of December, and pig iron, which hitherto had held up very well, fell several shillings all round. The result of this is that more men are being thrown out of employment every week. The finished iron trade is very bad, and buyers of all kinds seem to be holding back in anticipation of a further reduction in prices.

The chemical and general manufacturing trades of the North of England show no change. Everything is going on from hand to mouth, and two or three factories on the Tyne are likely to close to await better times.

GAS EXPLOSIONS AT SHEFFIELD.—On Thursday evening, Dec. 24, a serious gas explosion occurred at the works of Messrs. John Brown and Co., Limited, in this town. One of the gas-mains running between the armour-plating mill and the press burst, probably in consequence of the frost, and large quantities of gas escaped through the crevices in the ground. At the time when this happened some men were conveying an armour-plate whilst in a welding heat to the press opposite the mill. The gas ignited by the hot plate, and immediately exploded. The ground was torn up, large stones were flung into the mill, and one of the workmen was thrown some feet, but not seriously injured. The works were in darkness for six hours, owing to the stoppage of supply. On Thursday last an explosion occurred at a house of ill-fame—No. 219, Rockingham Street—kept by a woman named Ashton. According to the Sheffield papers, the house is the end one of a row of four, with palisadings in front of them. There were two entrances—one from the street and the other from the yard at the back. The yard was exclusively used by the occupants of this house, which looked very substantial, was built of brick, and contained a front drawing-room, a sitting-room, and kitchen on the ground floor, while over these were bed-rooms and attic above. With the exception of the kitchen, all the apartments were lavishly filled with costly furniture, and beautifully decorated. For some days past a smell of gas had been perceived, and between six and seven o'clock in the evening of Thursday an explosion of gas took place in the kitchen, by which the servant was slightly injured. Besides Mrs. Ashton and her servant, Hannah Fell, there lived in the house three young women, known by the names of Ada Bennett, Lucy Bell, and Adelaide Barker. All these persons, accompanied by some men, where in the house on Thursday evening. As it was believed there was a serious escape of gas somewhere about the premises, the place of which could not be discovered, another messenger was despatched to the gas offices, and workmen were sent to examine the mains. A defect was found in the main outside the house, whence gas had been escaping for some time in large quantities. The men set to work to repair the fissure. Shortly after ten o'clock a loud explosion was heard. The floors were uplifted, the windows smashed, the furniture and pictures pitched from their places, and in a few seconds the back portion of the walls and roof tumbled. The interior of the building was rendered a complete wreck, and the outer walls at the back were completely razed, letting down the roof. The other walls withstood the shock, but the doors and windows were shattered to atoms. The damage is so great that it is marvellous any of the inmates escaped with their lives, but singular enough none of them sustained any dangerous injury. Mrs. Ashton, who was in the kitchen, experienced the full force of the explosion. She was pitched from her seat into the ruins, and in her eagerness to escape she injured her foot, and damaged the greater part of her apparel. The men, who are unknown, apparently escaped uninjured, as they decamped as speedily as possible; and the other women in the house, who were in the sitting-room and kitchen, only sustained slight contusions and bruises. The damage to the premises will be considerable, inasmuch as the furniture and adornments of the rooms were all new and of a very expensive description, and they now lie amid the heap of ruins. The greater part of the house will have to be rebuilt before it will be fit for occupation again. It is supposed that a large quantity of gas had accumulated underneath the kitchen, and, coming in contact with the lights, exploded. Great consternation was caused in the neighbourhood, the report being heard for a considerable distance.

REDUCTION IN THE PRICE OF GAS.—The Lewes Gas Company announce a reduction of 5d. per 1000 cubic feet, the present price being 4s. 7d.

GAS POISONING AT OLDHAM.—On Christmas night three men, named Thomas Rimmer, Thomas Thompson, and Edward Gunner, went to bed at their lodgings in Radcliffe Street. About eight o'clock the following morning the landlady, Mrs. Nixon, went up stairs for the purpose of arousing them. On going into the bed-room she perceived a strong smell of gas, which was issuing from an open gas-pipe. One of the men was lying on the floor, and all three were in an unconscious state. Medical assistance was procured and restoratives were applied, but it was a long time before the men regained consciousness.

COLCHESTER GAS COMPANY'S BILL.—A public meeting was held in the Public Hall, Colchester, on Thursday evening last, to consider the proposed bill of the gas company. Mr. A. Neck presided, and Mr. Jones moved a resolution to the effect that in the absence of information showing the basis upon which the application to Parliament for increased powers was supported, the meeting pledged itself to oppose the bill. Mr. H. M. Davey seconded the motion, which, after some discussion, was carried; as was also one proposed by Mr. Paxman, and seconded by Mr. J. S. Barnes, appointing a committee of five to meet any sub-committee appointed by the Town Council to open negotiations with the gas directors with a view to an amicable arrangement.

ACCIDENT AT THE LEYBURN GAS-WORKS.—Last Friday evening, between seven and eight o'clock, the gasman in connexion with the above-named works was attending to his duties, and it appears, from what can be ascertained, that a plug was blown out of a pipe containing gas tar and gas, which had taken fire, and for a considerable time the flames from it were burning over the body of the unfortunate man. In a short time the woodwork of the gas-house was in flames. The gasman, whose name is Shipley, was sought for, and was found lying in the midst of the flames, burnt dreadfully about the head and body, but unable to give any account of what had taken place. The fire was soon subdued, and with slight injury to the building. Leyburn, however, was left in darkness, and will probably have to remain so till after the breaking up of the storm. We are given to understand that the frost was the sole cause of the mischief. Shipley is now in a very dangerous condition.—*Leeds Mercury.*

HULL GAS SUPPLY.—Mr. Baynes reports the results of his examination of the gas sent into the Sculcoates and Myton district by the British Gaslight Company during December, also the mean of means for the past half year. During that period 77 examinations were made in respect of illuminating power, and 27 quantitative analyses for chemical purity. At no time was sulphuretted hydrogen or free ammonia present to the ordinary tests. The general character of the gas was satisfactory. The experiments were made with Sugg's 15-hole elliptical burner.

	Max.	Min.	Mean.
Illuminating power standard sperm candles	16·50	14·42	15·68
Six months	16·58	15·25	16·09
Grains of sulphur per 100 feet	28·50	16·50	24·00
Six months	25·65	19·10	22·70
Grains of ammonia per 100 feet . . .	—	—	·40
Six months	·40	·30	·36

Mean barometer and temperature in experiment-room:—Bar., 29·88; tem., 53°

LIVERPOOL.—THREATENED FAILURE OF THE GAS SUPPLY.—Christmas-tide was near being celebrated in Liverpool in a fashion very different to the generally-adopted mode. The long-continued frost has for some time past blocked up the railway systems around Liverpool and district, and consequently the supply of coal to the Liverpool Gas-Works was greatly reduced. So great, indeed, was the want of material that the managers of the works suddenly found themselves face to face with a crisis of a very alarming nature, the prospect of a complete failure of the gas supply, and the consequent involving of the town in darkness. This disagreeable and dangerous, and fortunately unprecedented, occurrence was only prevented by the energetic action on the part of the authorities. The railway companies were communicated with, and by dint of great exertions a number of waggons were detached and sent off in hot haste to the gas-works, where their contents were speedily converted into gas. The only intimation the public have hitherto had of the narrow escape from total darkness was a slight diminution of the illuminating power and pressure of the gas at the end of last week.—*Leeds Mercury.*

GAS EXPLOSION AT WIRKSWORTH.—On the 28th ult., an explosion of gas, fortunately unattended with serious results, occurred at the residence of Mr. Ogden. A strong smell of gas was perceived during the night, and the following morning a man was sent for to examine the pipes. Finding no escape from the services, it was thought the smell proceeded from the main, but whilst in the entrance-hall a match was struck when an explosion immediately followed. The explosion did not do much damage beyond blowing up the tiles in the passage, doorsteps, &c., and blowing down the outer door leading to the street. This was about eight o'clock in the morning, and towards ten o'clock a second explosion followed at the house of Mr. Beeson, next door, blowing up grates, stones, and other material. In this instance the gas ignited in the wash-house, as the charwoman was in the act of making a fire. The woman was blown across the room and fell on some stairs, and received a severe shaking, but no bones were broken, although she informed Dr. Milligan, who was called in, that she was "killed." The workmen at the gas-works were at once communicated with, and the gas turned off from the main altogether, when an investigation was made, resulting in the discovery of a leakage in the pipe. Owing to the severe frost the ground was very hard and difficult to break up, but the workmen eventually got down to the main, and the broken pipe was repaired.

ABANDONMENT OF PROPOSED GAS-WORKS FOR CLIFTON WORKHOUSE.—At the meeting of the Clifton Board of Guardians on the 18th ult., Mr. Edwards moved the rescinding of the resolution come to on the 4th inst., to erect gas-works for the supply of the workhouse. In doing so, he said he held in his hand a memorial signed by nearly sixty persons, owners of property and occupiers of land in the immediate locality of the workhouse, protesting against the erection of a gas-work on the workhouse land. He believed if the guardians carried out their intention they might expect to have five or six actions immediately brought against them for compensation for damage done to property in the locality. He denied that there would be any saving effected by the erection of the gas-works, and said the whole of the cost of gas for lighting the workhouse was £128 per annum, and that included the whole expenditure. He pointed out that the outlay for the works would be very great, and would probably exceed £1000; and he contended that, what with the interest they would have to pay on the capital expended, the money they would have to pay for labour, and the providing for wear and tear, the gas would cost the guardians more than they paid at present. The memorial referred to was handed in. It was signed by 59 owners and occupiers of the neighbourhood, and protested against the erection of gas-works, which the memorialists considered would be a nuisance to the neighbourhood. A letter was also read from Mr. D. Horwood, of Grove Villa, Stapleton Road, objecting to the works being constructed. Mr. J. Yalland seconded the motion, and said one objection he had to the works was that the wells in the neighbourhood would be poisoned by the emanations from the gas factory. He indicated objections to the employment of pauper labour, pointing out that the men could at any time demand their discharge, and leave the workhouse without light. He believed that the gas would cost the guardians more than they paid the gas company. After a rather personal discussion the motion to rescind the former resolution was put and carried.

BIRMINGHAM WATER SUPPLY.—Dr. Hill, the medical officer of health for Birmingham, reports that the water supplied to that town during the past month was "pretty clear," but again draws attention to the "large amount of organic nitrogen" which it contains.

GLASGOW WATER SUPPLY.—Professor Bischof, of the Andersonian University, Glasgow, reports that the Loch Katrine water supplied to that city, although slightly yellowish and turbid, was, as usual, entirely free from all traces of previous sewage or animal contamination.

STREET INDICATORS.—We are glad to see that the suggestions we have from time to time given as to the names of the streets being indicated, either on the street-lamps or on the lighted up postal-pillars, are having some practical effect. In Piccadilly it is already done, and the parish of Lambeth are advertising for plans and tenders for the same, which will no doubt lead to some relief of the present confusion of darkness.—*The Builder.*

EXPLOSIONS OF GAS AT DURHAM.—Early on Saturday evening last a serious gas explosion occurred on the premises of Mr. Gray, tailor and draper, North Road, Durham. Mr. Gray was blown into the road and the shop took fire. Two children were buried in the *débris*, and were conveyed to the hospital, where one of them died during the night. Mrs. Gray, with her infant three weeks old, was rescued, as also was her sister. Another explosion occurred about two hours afterwards in the same street, two people being injured.

NEW GAS-WELL IN PENNSYLVANIA.—A well has been sunk at Freeport, Pa., by Messrs. Rowand and Murphy, to the depth of 1200 feet. They have gas enough now to furnish steam for their planing-mill, but will sink deeper, as they want enough to light up the town. They will not object to striking a vein of oil, but it is said they do not expect to be so fortunate. However, there is nothing like trying.—*American National Oil Journal.*

CHICAGO WATER SUPPLY.—Chicago is supplied with water by means of a tunnel two miles long carried out to the middle of Lake Michigan. The capacity of this tunnel is stated to be 57 million gallons per day, and yet Chicago commenced, in 1872, building another tunnel (nearly twice as large as the first), which will, it is expected, be ready for use at the commencement of 1875. Chicago will thus next year have water supply arrangements adapted for a population of about 5 millions.—*American Gaslight Journal.*

VILLAGE WATER SUPPLY IN AMERICA.—Few people outside of our villages are aware how increasingly difficult is the question of pure water supply. In most of our small towns the wells are adjoining cesspools and stables, and receive more or less of the constant drainage of the latter. A chemical analysis was made during the past year of the water from the wells of one of our most thriving towns—Ithaca—and most of them were found infected with poisonous animal matter. One house, whose well showed the worst composition, had been afflicted with terrible diseases. It is well known to physicians that nothing conveys typhoid or cholera like drinking-water which is infected with cesspool drainage.—*New York Times.*

DEATH OF MR. JOSEPH HADLAND.—The death of this gentleman took place at his residence, Eldon Park Lodge, South Norwood, on the 24th ult. Mr. Hadland was in his 81st year. He was for some years an auditor of the City of London Gas Company, and was elected director, on a vacancy occurring at the board of that company in 1861. The following year he was appointed deputy-chairman, and continued to hold that office until the amalgamation of the company by The Gaslight and Coke Company in 1869, when, under the provisions of the scheme approved by Order in Council, he became a member of the board of the united company. Mr. Hadland was also one of the auditors of the Continental Union Gas Company.

HEATING APPARATUS FOR DOMESTIC PURPOSES.—A new form of heating apparatus, intended to warm comparatively small quantities of water at a time, has recently been patented by Mr. Strode. A vertical chimney is arranged over a set of Bunsen burners. This chimney consists of an inner and outer cylinder, and in the jacket thus formed a current of water is allowed to flow, taking up the heat as it goes from the heated surface of the inner cylinder. The water is admitted cold at the bottom, and discharged at the top heated. The invention is intended for use in positions where a complete heating apparatus for hot water supply with cisterns, &c., cannot be constructed.—*Journal of the Society of Arts.*

EFFECT OF HYDROGEN ON IRON.—Iron or steel wire which has been acted on superficially by sulphuric acid is usually found to be altered in its properties. Its weight is increased, its tenacity is injured, so that though originally soft and flexible, it easily breaks; and when a freshly broken end is moistened by the tongue it effervesces as if acted on by a mineral acid. These effects after a time disappear. Prof. Osborne Reynolds, of Manchester, has ascertained that they are owing to the absorption of hydrogen generated during the chemical reaction which takes place when the wire is immersed in the acid. He found that, if an iron tube, closed at one end, be immersed in a dilute solution of sulphuric acid, hydrogen passes through the walls of the tube into the interior, and may be collected by attaching an india-rubber tube to the open end of the iron one, and passing it under a gasholder. Prof. Reynolds concludes that, whenever iron undergoes oxidation under water, it becomes saturated with hydrogen, and thus loses tenacity—an important consideration in the case of steam-boilers or iron ships.—*President Barnard.*

LIVERPOOL AND MANCHESTER WATER SUPPLY.—Mr. C. F. Bateman, who has been called in to advise the Liverpool Corporation on a further supply of water to that city, and who is the chief water engineer of the Manchester Corporation, recommends the two cities to combine in promoting a scheme to take ultimately 80 million gallons per diem from Ullswater and Haweswater. He states that there are no works of any consequence to be contemplated, the chief being Kirkstone Pass, in tunnelling through which he sees no difficulty. He says that in four or five years the two towns can be supplied with 20 million gallons of water per diem each, at a cost of £2,000,000 each, taken from Ullswater. If Liverpool alone were to be supplied from these lakes, they could obtain 20 million gallons per diem, at a cost of £2,400,000, a portion of the works being made sufficient to carry 40 million gallons when required. As Mr. Bateman says that the streams supplying Ullswater in drought are only equal to 7 million gallons per diem, it would be necessary so to raise the lake as to store 100 days supply to meet these quantities and the needful compensations.

MAKING A GAS-WELL USEFUL.—An abandoned oil well at Leechburg, Pa., from which much gas but no oil has been obtained, is now being utilized and made to yield a profit as large as if its product was petroleum itself. The well was put down some time ago in search of oil, and when at the depth of 1200 feet a vein of gas was opened, the flow from which was so great as to prevent further drilling. The well was abandoned, when Mr. Rogers, of the firm of Rogers and Burchfield, conceived the idea of utilizing the rapidly wasting gas in furnishing fuel for their rolling-mill. He purchased the well, and fitted up a large iron receiver, where it was freed from the water with which it was impregnated when thrown from the well. From this receiver the gas is conducted a distance of 1000 feet to the rolling-mill, through a 2-inch pipe. They are burning it under a battery of four large boilers, which produces steam sufficient to run seven pairs of rolls and two large steam hammers. The amount burned in the mill does not amount to one-tenth of the supply furnished by the well; and the firm now propose to lay a larger pipe, and carry the gas to their annealing and sheet furnaces. Mr. Rogers expresses the opinion that it produces a better and purer heat than coal, and enables them to produce a larger quantity of iron. By the use of the gas the firm saves the price of 1000 bushels of coal—about 100 dols. per day.—*American National Oil Journal.*

THE SUB-WEALDEN EXPLORATION.—The ninth quarterly report of this exploration has just been issued by Mr. Henry Willett, the honorary secretary. It would appear that very little has been done for some time past, owing to the obstructions in the boring-hole not having been removed. The Diamond Boring Company, however, have promised that this shall be done as soon as possible, and, as the honorary secretary points out, the contractors cannot afford to fail. Attention is drawn in the report to a lately published memoir of Professor J. Gosselet, of Lille, on the coal-fields of the North of France. In it the professor says: "I do not agree in the opinion either of Mr. Prestwich or of Mr. Godwin-Austen, and so far from making the coal basin pass to the north of London, according to the former author, or in the Thames Valley, as the latter supposes, I believe that it should be sought for in South Kent, in Sussex, and in Hampshire. I have also good hope that the boring now undertaken by the English, and persevered with so skilfully, will find either coal or the adjoining strata. The commencement of coal boring on our side would be as important for us as for England." The discovery of gypsum in Sussex is spoken of as one of the triumphs of the Sub-Wealden Exploration. On Mr. Egerton's estate adjoining, sheds have been erected, a shaft sunk, and the gypsum has been reached by boring at the depth anticipated. In Archer's Wood, distant about three miles N.E., Mr. Bosworth also discovered gypsum (by boring) at a depth of 169 feet, and then abandoned the search.

A CHALDRON OF COALS.—Some useful information with regard to the legal weight of a chaldron of coals is given in the report of the Warden of the Standards (Board of Trade) just issued. It appears that, during the past year, an application was made to the Standards Department on the part of the Dean and Chapter of Westminster, for an authoritative statement of the legal weight of a chaldron of coals, the question raised being whether a chaldron of coals was equivalent in weight to 24 cwt. or 24½ cwt. In the reply to this question it is stated that the chaldre, chalder, or chaldron of coals, was originally a measure containing 36 Winchester bushels. The legal coal bushel was altered and made a little larger in 1713, and was defined as a measure made round with a plain and even bottom, 19½ inches from outside to outside, and to contain one Winchester bushel and one quart of water. A standard coal bushel was made and kept at the Exchequer in pursuance of the provisions of this Act. The legal measure of coals was regulated by this standard coal bushel until the imperial coal bushel was legalized, in 1824, as the only standard measure. In 1835 it was enacted that coals were to be sold by weight only. The weight of a chaldron of coal appears to have been first defined in 1695, so far as regards the carriage by sea of Newcastle coals, when 53 cwt. were allowed to every chaldron. This chaldron, however, was known as "Newcastle measure;" but in a later statute of the same year an equivalent duty of 5s. per chaldron was imposed upon coals sold by measure, reckoning 36 bushels to the chaldron, Winchester measure, and per ton upon coals sold by weight, showing the chaldron of coals to be considered as equal in quantity to the ton of coals. Although the sale of coals by weight was made imperative throughout the United Kingdom by the above-mentioned Weights and Measures Act of 1835, a local Act, passed in 1831, had previously required all coals to be sold by weight and not by measure, from and after the 1st of January, 1832, within the cities of London and Westminster, and within the distance of 25 miles of the General Post Office. Section 44 of this Act enacted that all contracts and agreements for the sale and delivery of coal by measure within these limits made previously, and not then completed, should be and continue in full force and virtue, except that such coals should be delivered by weight and not by measure, and for that purpose 25½ cwt. should be considered and taken to be equivalent to the chaldron. This is, therefore, the equivalent in legal weight of a chaldron measure of coals within 25 miles of the General Post Office. Householders are perhaps not generally aware that, while coal can be legally sold by weight only, coke is (or ought to be) still sold by measure only, under the provisions of the Weights and Measures Act of 1825, 5 Geo. IV., cap. 74, modified as to the regulations for heaped measure by section 8 of 5 & 6 Will. IV., cap. 63, under which a bushel of coke sold is to be the quantity contained in an imperial bushel "filled in all parts as nearly to the level of the brim as the size and shape of the article will admit." Section 8 of 5 Geo. IV., cap. 74, directs that three bushels shall be a sack, and 12 such sacks shall be a chaldron.—*Pall Mall Gazette.*

Register of New Patents.

1619.—FROST, H., Manchester, "*Improvements in fluid-meters, applicable also to apparatus for obtaining motive power, and for pumps.*" Patent dated May 7, 1874.

This invention consists of a new combination of apparatus for actuating the valves of fluid-meters, water-power engines, or pumps by the fluid pressure.

The improved apparatus consists of a casting having the necessary ingress and egress ports in the lower or horizontal part for communicating with the cylinder or measuring chambers, and ports through the vertical part for admitting fluid to and from a small supplementary cylinder affixed to the inner side of the upright part. In the cylinder works a piston having a piston-rod attached to it for actuating the main valve, which works on the lower or horizontal part of the casting. On the opposite side to that to which the small cylinder is affixed is a double-ended valve having a passage connecting the two openings near the ends, or in some cases an ordinary D or a double D valve is used. These valves are actuated by the rod of the main piston or otherwise from the measuring chambers or cylinders, and they are either flat on their face or V shaped.

The passages or ports are made to suit the different forms of valves. These several parts combined constitute the new combined mechanical arrangement for effecting the required motion of the ingress and egress valves of fluid-meters, motive-power engines, or pumps by the fluid pressure in a more perfect manner than has hitherto been done.

Another modification of apparatus consists in the use of a square block casting, with its upper side angular or V shaped, and having a midfeather or division plate above. A square or angular shaped moveable box is made to fit into the groove and rest on the midfeather. This box has flanges from its outer sides to cover openings or ports in the bottom of the groove; it is traversed to and fro by the pressure of the fluid, and by it the openings or ports are alternately opened and closed for admitting fluid to and from the measuring chambers. A valve is also made to work on the side of the square block for admitting fluid to and from the moveable box for giving the to-and-fro sliding motion to the same. This valve can be worked from a rod connected to a piston, or to a square or other shaped ram operating in the measuring chambers or otherwise.

With this improved form of valvular arrangement the ram or main piston of the meter or motive-power engine or pump can be worked either vertically or horizontally; the valve is made to slide vertically or horizontally, or it may be made to swivel from a centre.

1670.—STUART, J. M., Queen Victoria Street, London, "*Improvements in gaseliers and in glass shades or globes for gas-burners.*" A communication. Provisiona protection only obtained. Dated May 11, 1874.

This invention has for its object improvements in gaseliers, and in glass shades or globes for gas-burners. Gaseliers are now commonly suspended by means of chains passing over pulleys, and having counterpoise weights attached, so that they can be raised and lowered. The gas supply is obtained by means of telescopic tubes, rendered gas-tight by means of a water seal. This arrangement is objectionable; the evaporation of the water leads to the escape of the gas, and frequently to explosions.

According to this invention the arrangement of chains and counterpoise weights is retained, but the water joint is dispensed with, and in place thereof a flexible tube is provided to connect the rising and falling portion of the gaselier with the descending pipe, which is in direct communication with the fixed system of pipes by which the gas is supplied. The moveable portion of the gaselier is provided with a basket or receptacle in which the flexible tube coils itself when the lights are raised; and when the lights are drawn down, the flexible tube is lifted out of the basket or receptacle, and is drawn straight, or nearly so, when the lights are in their lowest position. The basket or receptacle may be between the burners of the gaselier, and, as heretofore, the moveable part of the gaselier may be provided with a tubular stem surrounding the gas supply-pipe depending from the ceiling. In this case the flexible pipe need never become visible. Or the basket or receptacle may be at the top of the stem of the gaselier, which, in this case, need not be tubular; the flexible tube should be neatly braided or ornamented externally, as it becomes visible whenever the burners are drawn down.

In order to prevent the flickering of the flame, resulting from the rapid air drafts through the narrow passages into and from the glass shades or globes at present in use, such shades or globes are, according to this invention, perforated with holes, arranged in an ornamental pattern, and in such manner as to give the air a much freer access to the flame than it has at present. Shades or globes of this construction have their full effect in softening the glare of the flame, and do not give rise to air currents of sufficient force to disturb the flame.

1698.—Warner, W. J., South Shields, and Cowan, W., Edinburgh, "*Improvements in gas-meters.*" Patent dated May 13, 1874.

This patent is named here in its numerical and chronological order, but the full specification, with illustrative drawings, appears in another page.

1709.—Budenberg, A., Manchester, "*Improvements in meters for measuring the flow of liquids.*" A communication. Patent dated May 14, 1874.

The features of novelty in this invention consist in constructing a meter with an outer casing internally divided by a cylindrical partition, the upper annular edge of which forms the seating of a valve of peculiar construction, which acts as a water-wheel for the purpose of measuring the flow of the liquid through the apparatus. This valve is formed with curved plates or vanes upon an inverted cylinder mounted inside the cylindrical partition, and is caused to revolve by the action of the liquid being measured, which is directed at a suitable angle against the curved plates or vanes as it enters the meter, the number of revolutions being indicated by counting mechanism upon a dial.

1711.—Beale, J., East Greenwich, "*An improved engine to be used for pumping gases, air, or fluids.*" Patent dated May 14, 1874.

This invention has for its object the construction of rotary engines in such a manner as to obtain increased lightness and simplicity of the moving parts, and consists in the use of two or more vanes or pistons carried round the interior of a cylinder by the action of an eccentric axle or drum, such vanes or pistons being maintained in their course by guide-blocks fixed thereto and working in annular grooves formed in the end plates of the cylinder and concentric therewith, or by other suitable means.

The axle or drum is slotted longitudinally in order to receive the ends of the vanes or pistons nearest to the centre of the cylinder, such ends being enlarged to portions of cylinders, which being pressed against by the sides of the slots in the axle or drum are driven round, the vanes or pistons being caused to maintain a radial position in relation to the centre of the cylinder by the curved guide-blocks working in the annular grooves in the end plates, or by the means hereinafter described.

By this configuration of the vanes or pistons, with only their ends enlarged to a partially cylindrical form in order to adapt them for working in the slots of the axle or drum, friction is diminished.

The cylinder is fitted with an inlet and outlet as usual, and on the axle or drum being caused to revolve the vanes or pistons by their actions produce a minus pressure at the inlet, and a plus pressure at the outlet.

1713.—Raines, W. N., Dukinfield, "*Improvements in pistons for steam-engines, pumps, and other such applications when packing is required.*" Provisional protection only obtained. Dated May 14, 1874.

This invention consists in expanding packing-rings by wedge-formed parts thereon.

1732.—Underhay, F. G., Clerkenwell, "*Improvements in apparatus for drawing off water to prevent or reduce waste.*" Patent dated May 15, 1874.

There are many purposes for which water is required; for example, for the supply of water-closets, where a free flow is required for a short time, and then should be arrested. In such cases it happens, sometimes from neglect and sometimes from derangement of the apparatus, that the flow is not stopped when the requirement for it has ceased, and much water is thus wasted. To prevent this waste is the object of the present invention.

The water after it has passed the draw-off cock, and before it arrives at the point of delivery into the pan of the closed or other receptacle, is caused to pass through a chamber, in the side of which is an orifice admitting of the escape of some of the water into a second chamber, in which is a float, which rises as the water accumulates, and in rising it closes a valve within the chamber, or otherwise suitably placed to arrest the passage of the water to the outlet. Near the bottom of the chamber containing the float is another smaller orifice, by which the water can slowly run out from float chamber. By this orifice the water which has passed into the chamber slowly escapes, so as after an interval of time to admit of water being again drawn off to the pan of the closet or other receptacle; or if the draw-off cock be kept permanently open in consequence of neglect or wilful misuse or derangement of the apparatus, the loss of water will be limited to that which can escape by the minute orifice at the bottom of the float chamber.

1733.—Pontifex, E. A., Shoe Lane, London, "*Improvements in apparatus to be used in drawing off water and other liquors, and in measuring the quantities drawn off.*" Patent dated May 15, 1874.

This apparatus consists of a cylinder, the ends of which are connected by pipes to a four-way cock, to which the supply and delivery pipes are also connected. By turning the cock into one position the supply goes to one side of a piston in the cylinder, thereby forcing it to the other end of the cylinder, and expelling the water which was in the cylinder through the delivery-pipe. To deliver another measured quantity, the four-way cock is turned and as before the pressure of the supply forces the piston to the other end of the cylinder, expelling the contents of the cylinder through the delivery-pipe. In this manner a measured quantity is delivered each time the four-way cock is turned.

1764.—Kidd, J. H., Wrexham, "*Improvements in the preparation and application of certain materials for deodorizing sewage, nightsoil, and like matters, and in the manufacture of artificial manures.*" Provisional protection only obtained. Dated May 19, 1874.

This invention consists in applying as a deodorizer, carbonaceous or coal shales or coal washings, heated or carbonized in a suitable furnace such as a retort furnace, and then pulverized if desired. When thus prepared it is mixed with the matters requiring to be deodorized. In treating sewage, the solid matter is allowed to settle in tanks, the surplus water is then drained away and salt or lime added; sufficient mineral carbon, or material obtained from carbonaceous shales or coal washings as above explained, is then added and mixed with the sewer sediment to cause it to dry readily. The material thus obtained is further and greatly enriched as a fertilizer by the addition and mixture of bone dust, nitrate of soda, sulphate of ammonia, and other like matters.

1787.—Darwin, S. B., Shrewsbury, "*Improvements in the method of lining or coating iron pipes.*" Provisional protection only obtained. Dated May 20, 1874.

This invention has reference to the lining or coating of either wrought or cast iron pipes or tubes with lead, tin, or other suitable metal or alloy or gutta-percha, or a mixture of gutta-percha and other material suitable for preserving and increasing the durability of the pipe and enabling it to withstand, when laid beneath the surface of the ground or otherwise, the action of any fluid, liquid, or other matter to which it may be subjected. The process for lining consists in placing within the iron pipe, which may be heated or not, an iron or other suitable core or spindle, leaving a space between it and the pipe corresponding to the thickness of the intended lining. The lead, tin, or other material is then melted and forced in by hydraulic or other pressure between the tube and the core. When the lining has cooled sufficiently, the core is removed, and the operation repeated for an additional length of the pipe, where the pipe is too long to admit of the whole being completed in one operation. For coating the pipe, a mould or barrel is passed over the pipe, sufficient space being left between it and the pipe to admit of the desired thickness of coating being applied, the operation of coating being similar to that of lining.

1799.—Alexander, E. P., Southampton Buildings, London, "*Improvements in liquid-meters; applicable also as a motive-power engine.*" A communication. Patent dated May 21, 1874.

This improved liquid-meter consists of a pair of oscillating cylinders mounted on concave supporting surfaces, and having corresponding convex port faces which fit and rock upon the concave fixed surface. Two inlet ports are made in the convex port faces, and a single outlet port in the concave fixed surface. The piston-rods of the cylinders are connected to crank-pins at right angles on a crank-shaft, which gives motion to the counting mechanism. The whole is enclosed in a liquid-tight box or casing, into which the liquid to be measured is under pressure admitted by a supply-pipe. The liquid in the casing gains access to each end of each cylinder alternately through one or the other of the inlet ports, which become exposed or fully open to the interior of the casing each time the corresponding piston arrives at the middle of its cylinder, or at half stroke. The measured liquid is forced out of the cylinders through the exit ports in the concave supporting surface, and passes thence to the exit-pipe. The same arrangement is also applicable as a light motive-power engine by bringing the shaft through the side of the closed casing.

1826.—Goodall, R., Leeds, "*Improved means or method of clarifying sewage and impure waters and rendering the precipitate or 'sludge' combustible and useful as fuel.*" Patent dated May 23, 1874.

This invention consists, first, in the employment of certain chemicals to precipitate the solid matter; secondly, in the employment of lime and chemicals; and, thirdly, in the employment of the chemical precipitants, lime, and small coal, to render the precipitate available for fuel.

1851.—Clark, A. M., Chancery Lane, London, "*Improvements in apparatus for carburetting air and regulating the supply to the burners.*" A communication. Provisional protection only obtained. Dated May 27, 1874.

This invention consists of a carburettor composed of a series of sections held together by bands and filled with an absorbent material, having tubes projecting inwardly from the closed bottoms of the sections, which are provided with reticulated top plates, whereby the parts may be separately and readily removed in case of fire, the absorbent being also thoroughly saturated. A governor is also described, consisting of a liquid valve chamber for receiving air, made of an inverted cup and two cylinders having a water chamber between them, the inner of which is made bottomless, but with a closed top. This serves to regulate the supply of carburetted air at the burners.

APPLICATIONS FOR LETTERS PATENT.

4363.—Gill, D., Weston-super-Mare, "An improved method for relieving private drains of sewer or drain gas." Dec. 18, 1874.

4365.—Spice, R. P., Westminster, "Improvements in the manufacture of gas." Dec. 18, 1874.

4366.—Herring, R., St. Helen's, Lancs, "Improvements in apparatus for securing the lids or covers of gas-retorts." Dec. 18, 1874.

4382.—Allen, S., Liverpool, "Improvements in and applicable to packing or rendering tight the spindles of valves." Dec. 19, 1874.

4386.—Spence, R., Greenock, N.B., and Mather, J., Gateshead-on-Tyne, "New or improved apparatus, which may be used for condensing vapours or gases for heating liquids, for purifying and bleaching oils and gases, and for other analogous purposes." Dec. 21, 1874.

4387.—Johnson, J. H., Lincoln's Inn Fields, London, "Improvements in the manufacture of hydrogen gas, and in the utilization of the bye or secondary products obtained in such manufacture." A communication. Dec. 21, 1874.

4388.—Lake, W. R., Southampton Buildings, London, "Improvements in the construction of cylinders for pumps and steam-engines." A communication. Dec. 21, 1874.

4403.—Davis, H. T., New Cross, "Improvements in the construction of traps for sinks, drains, and other conduits for water and other fluids." Dec. 22, 1874.

4404.—Munford, A., South Petherton, Somerset, "Improvements in apparatus for lighting and extinguishing street and other lamps." Dec. 22, 1874.

4410.—Kirkwood, J. T., Yeo Vale, Devon, Lascelles, C. T. E., New Cross, Kent, and Hall, J., Peckham, Surrey, "Improvements in the construction of gas-engines." Dec. 22, 1874.

4413.—Powell, J. W., Bermondsey, London, "Improvements in apparatus for regulating and controlling the supply and flow of water and other liquids." Dec. 23, 1874.

4420.—Willis, H., and Blick, J., Worcester, "Improvements in equilibrium slide-valves for steam-engines and engines worked by compressed air, gas, or water." Dec. 23, 1874.

4427.—Mann, W. T., Liverpool, "Improvements in or connected with hydraulic presses and pumps." A communication. Dec. 23, 1874.

4431.—Wanklyn, J. A., London, "Improvements in the purification of water." Dec. 23, 1874.

4436.—Saxby, F. E., Liverpool, "Improvements in condensers for steam pumping-engines." Dec. 24, 1874.

GRANTS OF PROVISIONAL PROTECTION.

4228.—Muller, J. A., Amsterdam, "Improvements in apparatus for measuring water or other liquids, applicable also as a current meter and motor." Dec. 9, 1874.

4234.—Foster, E., Halifax, "Improvements in taps and valves." Dec. 9, 1874.

4239.—Weston, J. H., Lansdowne Road, Surrey, "Improved apparatus to be connected with open gas-burners for supporting half-globes or reflectors, and for increasing the reflective property of the flame." Dec. 9, 1874.

4247.—Morrell, J. C., Leyland, Lancs, "Improvements in the construction of sewer-pipes, drain-pipes, and modes of treating sewage." Dec. 10, 1874.

4262.—Perrett, E., Westminster, "Improvements in filters, and in the method of cleaning the same." Dec. 10, 1874.

4271.—Murdoch, H. H., Staple Inn, London, "Improvements in screw-taps." A communication. Dec. 11, 1874.

4290.—Verdier, C., Rue Lafayette, Paris, "An improved water-meter and feeder apparatus for boilers." A communication. Dec. 12, 1874.

4297.—Binnie, R., London, "Improvements in condensing apparatus for steam pumping-engines." Dec. 14, 1874.

NOTICES TO PROCEED.

2797.—Jones, F. St. J., Worcester, "Improvements in taps and valves for regulating the flow of gas and other fluids." Aug. 13, 1874.
2802.—Henry, M., Fleet Street, London, "Improvements in the method of and apparatus for obtaining ammonia from waste products and other matters." A communication. Aug. 13, 1874.
2847.—Russ, B., Little Ilford, Essex, "Improvements in the manufacture of gas, and in the apparatus connected therewith." Aug. 18, 1874.
2901.—Knowelden, J., Bermondsey, London, "Improvements in steam, water, or other fluid engines." Aug. 25, 1874.
3751.—Mackay, G., Edinburgh, "An improved process of purifying liquids and recovering matter contained therein." Oct. 30, 1874.
3792.—Fogarty, T. B., Warren, Massachusetts, U.S.A., "Improved apparatus for carburetting air or other gaseous bodies." Nov. 3, 1874.
3988.—Walker, W. T., Highgate, London, "Improvements in the construction of gas-purifiers." Nov. 20, 1874.
4036.—Brooks, F. W., New York, U.S.A., "Improvements in meters for measuring water and other liquids." Nov. 24, 1874.
4111.—Crossley, L. J., and Hanson, R., Halifax, and Hicks, J. J., Hatton Garden, London, "Improvements in water-gauges." Dec. 1, 1874.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

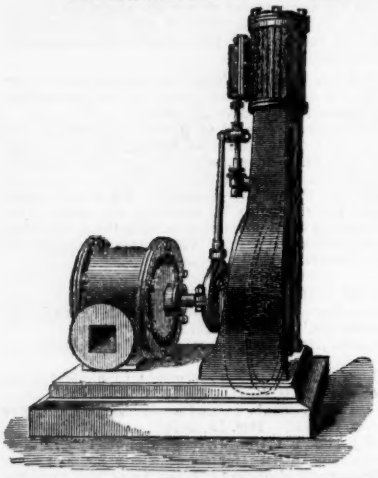
2220.—Tackels, C. J., Brussels, "Improvements in gas-burners." June 26, 1874.
2245.—Morgan, O. V., Kensington, and Moelchaerek, G. R., Battersea, London, "Improvements in stoneware filters and coolers for filtering and cooling water." June 29, 1874.
2274.—Connell, W., Glasgow, "Improvements in valves for water-supplying apparatus." July 1, 1874.
2338.—Wells, J., Wednesbury, "Certain improvements in main-cocks for gas and water purposes, but which said improvements are also applicable for main-cocks for the controlling of other fluids." July 4, 1874.
2397.—Wilson, H., Stockton-on-Tees, and Steel, J., Glasgow, "Improvements in apparatus for cooling and heating liquids and gases." July 8, 1874.
2428.—Mackenzie, T., Wednesbury, "Improvements in steam pumping and blowing machinery." July 10, 1874.
2496.—Wise, W. L., Adelphi, London, "Improvements in apparatus for purifying and filtering water." A communication. July 16, 1874.
2587.—Aitken, H., Falkirk, "Improvements in the manufacture of illuminating gas, and in the apparatus or means employed therefor." July 24, 1874.
2605.—Wise, W. L., Adelphi, London, "Improvements in stop-valves." A communication. July 25, 1874.
3472.—Scott, H. Y. D., Ealing, Middlesex, "Improvements in the manufacture of ammoniacal salts." Oct. 9, 1874.
3489.—Haseltine, G., Southampton Buildings, London, "Improvements in apparatus for feeding gas-retorts, and for other analogous purposes." A communication. Oct. 10, 1874.
3549.—Hamilton, J., Smethwick, "Improvements in direct-acting pumps, worked by steam or compressed air." Oct. 15, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3268.—Mann, W., "Improvements in the method of purifying gas, and in the apparatus employed for that purpose." Dec. 2, 1871.
3280.—Newton, H. E., "Improvements applicable to street and other gas-lamps for the purpose of preventing stoppages in the supply-pipes." Dec. 5, 1871.
3285.—Jervis, A., "Improvements in economic water-supply apparatus." Dec. 6, 1871.
3297.—Ebdy, T. C., "Improvements in stoves for warming, ventilating, and disinfecting buildings, and heated by gas, coke, mineral oils, or other fluids." Dec. 7, 1871.
5344.—Moffatt, J., "Improvements in apparatus for making illuminating gas." Dec. 11, 1871.
3348.—Eveleigh, G., "An improved means of purifying gas from ammonia." Dec. 11, 1871.
3367.—Bray, J., "Improvements in apparatus for measuring water and other fluids." Dec. 13, 1871.
3396.—Harrison, C. W., "Improvements in gas-burners." Dec. 14, 1871.

BEALE'S IMPROVED PATENT GAS-EXHAUSTER



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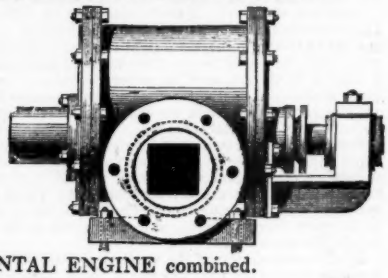

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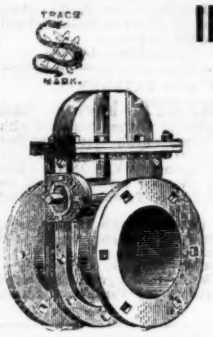
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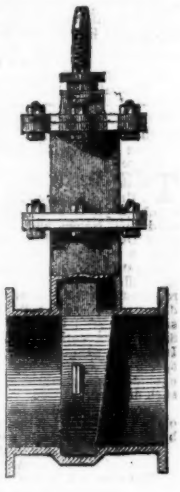
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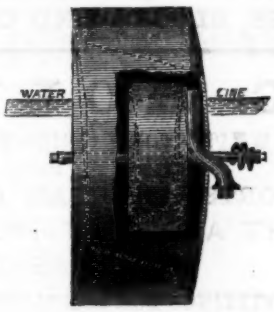

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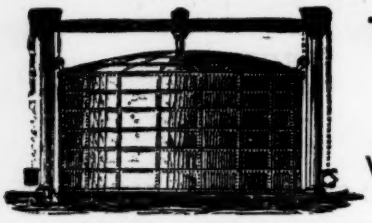

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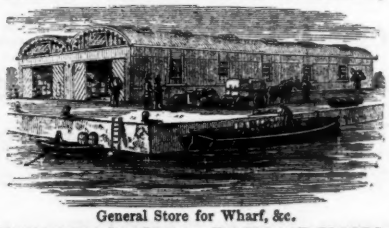

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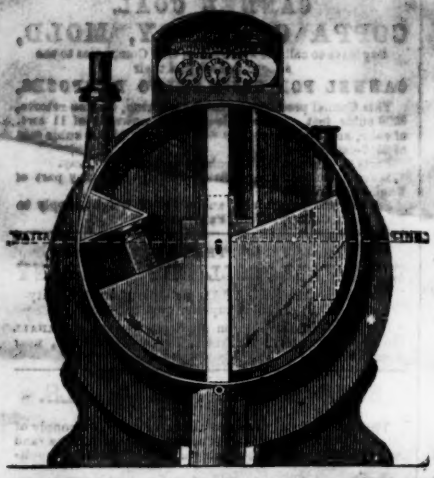

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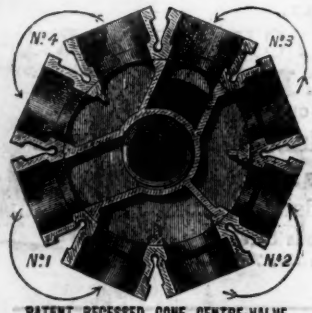

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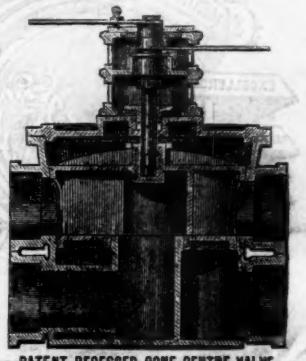

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